DOCUMENT RESUME

ED 322 568 EA 022 003

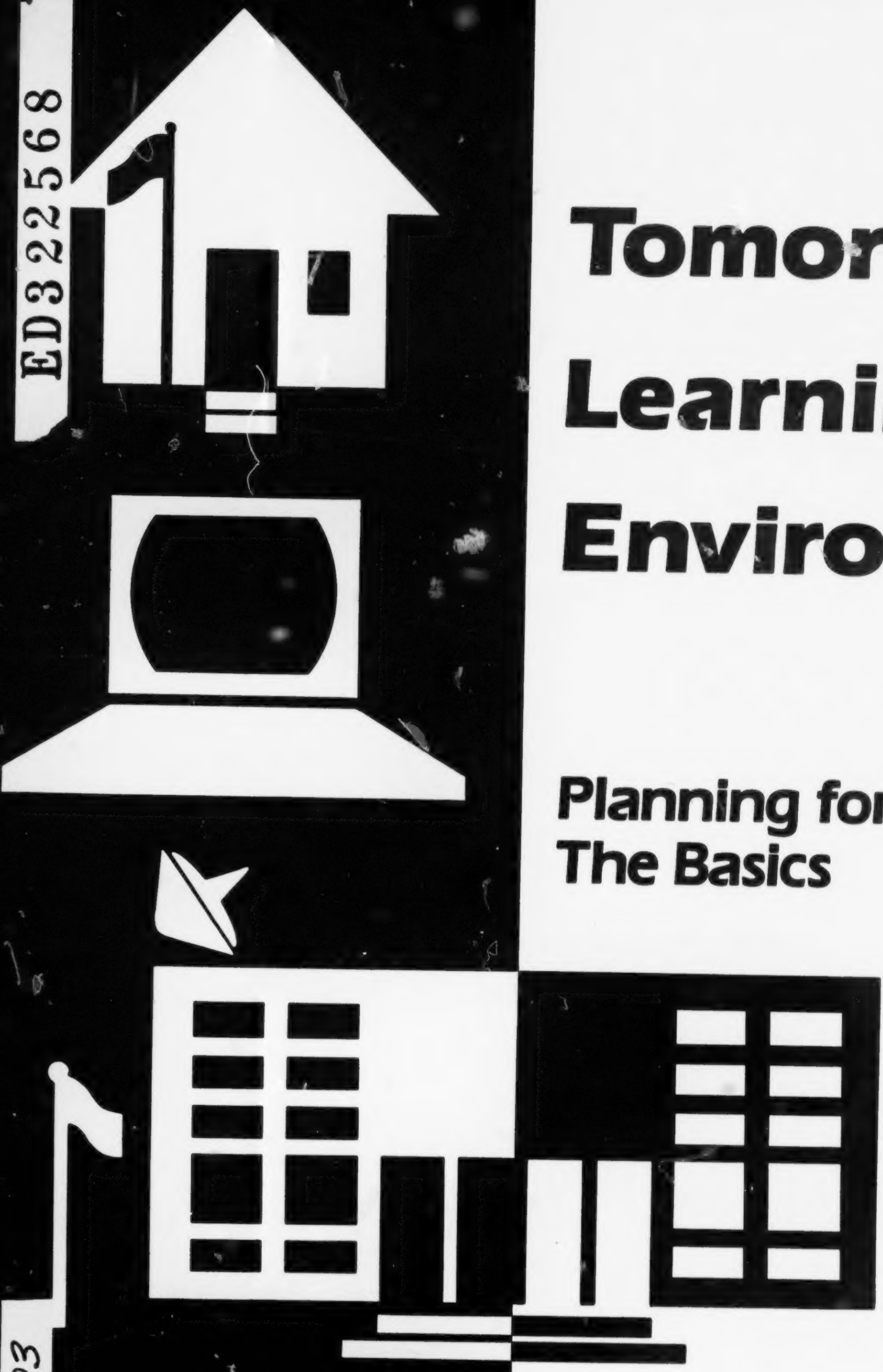
AUTHOR	Hill, Franklin
TITLE	Tomorrow's Learning Environment. Planning for Technology: The Basics. A Technology Leadership Network Special Report.
INSTITUTION	National School Boards Association, Alexandria, VA. Inst. for the Transfer of Technology to Education.
PUB DATE	88
NOTE	151p.
AVAILABLE FROM	Publications, National School Boards Association, 1680 Duke Street, Alexandria, VA 22314 ($35.00).
PUB TYPE	Guides - Non-Classroom Use (055) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Board of Education Role; Classroom Design; *Educational Facilities Planning; *Educational Technology; *Educational Trends; Elementary Secondary Education; Facility Requirements; *Futures (of Society); Learning Resources Centers; Master Plans; School Business Relationship; School Districts; Self Evaluation (Groups)

ABSTRACT

In order for technology to fulfill its potential for substantially improving school productivity, it must be an integral part of school facilities planning. This report tells how technology-specific issues fit into the more general business of facilities planning and management. Topics covered include the following: (1) a questionnaire to help school districts create a status report on instructional technology and facilities planning; (2) an overview of technology in the media center; (3) an overview of accommodating specific instructional innovations in school spaces; (4) an outline of the planning process in the development of a Florida high school; (4) educational specifications for remodeling and new construction; (5) the use of program management firms; and (6) topics of concern to school board members such as state's responsibility, cost control, selecting a design professional, and passing a bond referendum. Appendixes contain the questionnaire format used to survey school board members; an article about science faculty master planning in Orlando Florida; comments from 12 reviewers of a draft of this publication; and an annotated bibliography of 44 citations in the ERIC database. (MLF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED322568



Tomorrow's Learning Environment

Planning for Technology: The Basics

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

J. Floyd

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

EA 022 003

NSBA

By Franklin Hill, Ph.D.

A Technology Leadership Network Special Report

BEST COPY AVAILABLE

Technology Leadership Network

Special Reports are one of the many benefits of participation in the Technology Leadership Network, part of NSBA's Institute for the Transfer of Technology to Education (ITTE). In addition to Special Reports, school board members and superintendents in Technology Leadership Network districts receive "Insider's Letter," a newsletter reporting on the latest developments in technology and the most successful applications of technology for education. Individuals from Technology Leadership Network districts also may take advantage of substantial discounts on a variety of ITTE meetings, publications, and services.

More than 150 school districts belong to the Technology Leadership Network, which was established by ITTE in 1986.

For more information on the Special Reports or NSBA's Technology Leadership Network, write or call the ITTE staff at the National School Boards Association, 1680 Duke Street, Alexandria, VA 22314, (703) 838-6722.

Single copies — $35

Bulk discounts available. For more information, contact ITTE.

TOMORROW'S LEARNING ENVIRONMENT

PLANNING FOR TECHNOLOGY: THE BASICS

DECEMBER 1988

By

Franklin Hill, Ph.D.

An ITTE Technology Leadership Network Special Report
from the Institute for the Transfer of Technology to Education
of the National School Boards Association

Leonard Rovins
President, NSBA

Thomas A. Shannon
Executive Director, NSBA

© 1988 National School Boards Association

CONTENTS

Foreword vii

Acknowledgements ix

About the Author xi

Chapter Summary xiii

Chapter I: Technology Is Here! 1

The Purpose of This Book 3
A Special Note to School Board Members 4
Tomorrow Is Here 6

Chapter II: School District Self-Evaluation for Facilities and Technology 7

The "Technology Elephant" 8
Technology Management 9
Facility Management Sequence 9
Facilities Technology Survey 10
Facilities Technology Questionnaire 11
Questionnaire 13

Chapter III: The Media Center: A "Bionic Heart" in an Electronic School 19

Reading Room/Stacks 21
Instructional Video 21
Reference Areas 22
Teacher Work Area 22
Conference Rooms 22
Closed Circuit Television 23
Security 24
Community Use 24
The Books 24

Chapter IV: Making Room for Technology in Schools 25

Elementary Classrooms 27
Middle School Electronic Neighborhoods 32
Science Facilities 33
Instructional Television 42
Accommodating Computer Workstations 46
Electrical Service Planning 49
Furniture for Technology 50
Heating and Air Conditioning 50
Building-wide Technology Planning 51

Chapter V: Industry & Education: Planning for Technology Together 53

Central Florida Demographics 54
The Challenge 55
Pre-planning Educational Specifications 56
Approaching Industry Partners 57
The Workshop 57
Site Visits 58
Walt Disney World 59
Sea World 61
General Electric 62
NASA 62
The Florida Solar Energy Center 63
WFTV Channel 9 and WWTV Channel 24 64
The Orlando Sentinel Newspaper 64
Report and Recommendations 65
Facility Planner Involvement 66

Chapter VI: Facility Master Planning: A Businesslike Approach to Educational Specifications 67

Purpose of Educational Specifications 69
An Historical Perspective 69
Minimum Standards for Educational Specifications 70
Educational Specifications as a Master Plan 73
Remodeling and Renovation 77
Facility Planning Personnel 78
Staff Involvement Throughout Design 79

Chapter VII: Program Management: Hiring Help 83

- A Typical Approach 84
- Facilities Program Management 85
- Construction Program Management vs. Hiring In-House Staff 89

Chapter VIII: Miscellaneous Topics of Concern to Board Members 91

- State's Responsibility 93
- Cost Control 94
- Selecting a Design Professional 98
- Re-using an Existing School 101
- Passing a Bond Referendum 103
- Change Orders 104
- Conclusion 108

Appendix I: Planning for the 21st Century - Questionnaire used to survey school board members regarding facility planning concerns 111

Appendix II: Science Facility Master Planning, Orange County Public Schools, Orlando, Florida 115

Appendix III: Wisdom from the Field 119

Appendix IV: Recommended Reading 129

FOREWORD

As technology advances to meet educational needs, educators are beginning to recognize it must be treated as an integral part of the educational system--not just as an add-on--if it is to fulfill its potential for substantially improving school productivity.

If technology is to be integral to the educational system, then it must also be integral to school facilities. This Technology Leadership Network Special Report, written in layperson's terms, helps school board members and administrators think comprehensively about how to relate their plans for technology in instruction to their master plans for construction and remodelling.

The challenges are many and varied. There's the question of space--rooms for computer labs, carrels in the media center for video viewing, corners of teachers' desks for electronic classroom management. And there's the intricacy of wiring for connectivity, so that equipment throughout the building, the district, and even the community can share information.

There are matters of lighting for video screens, arrangement of rooms for easy access to technology "hubs," easing future additions of innovations yet to be invented, and securing valuable equipment away from harm.

This report tells how these technology-specific issues fit into the more general business of facilities planning and management, and offers examples of how particular technology applications can be integrated into school buildings. Many of the examples are drawn from the author's experience as facilities planner on the design team for the Dr. Phillips High School in Orange County, Florida, where he brought educators together with local industry representatives to learn about the state of the art in building to accommodate technology.

Tomorrow's Learning Environment is the fourth in a series of Special Reports from NSBA's ITTE and its Technology Leadership Network. These reports result from a two-step process:

- In step one, a topic of interest to school districts in the Technology Leadership Network is selected, a manuscript is prepared, and the manuscript is distributed to the school districts and to experts in the field for their critique and additions.
- In step two, the author(s) and the ITTE staff revise and expand the publication. Thus, ITTE and the school districts share their knowledge and experience within the Technology Leadership Network and beyond.

Previous reports have covered school use of videodiscs, the relationship of technology to the political demand for school reform, and two-way interactive television for distance learning.

If your school district is a leader in the use of technology but is not yet a part of the ITTE Technology Leadership Network, please contact ITTE for more information about the Network and its conferences, meetings, site visits, pilot project opportunities, publications, and special discounts.

Leonard Rovins
NSBA President

Tom Shannon
Thomas A. Shannon
NSBA Executive Director

ACKNOWLEDGEMENTS

While I have taken many years to formulate the ideas in this book, the final product would not have occurred without the support and encouragement of friends and associates. I must first thank Dr. James Mecklenburger, director of ITTE, for commissioning this publication and Anne Ward, ITTE publications coordinator, for her valuable comments and contributions.

To my colleagues in the Council of Educational Facility Planners International and particularly its past executive director, Dr. Dwayne Gardner, I am indebted for professional support and resources in education and facility planning.

I am also indebted to Dr. James Scott, superintendent, and Tom Ewart of the facilities division of Orange County Public Schools for supporting the involvement of local industry in planning Dr. Phillips High School in Orlando, Florida. Special indebtedness is also expressed to the PDR Architects -- Roger Pierce, president, and Fred Rohrdanz, vice president -- for whom I was an employee as vice president of educational facility planning, and to Brooks Weiss, president of Catalyst Architecture, for also allowing the inclusion of industry in the educational facility planning process.

I want to extend special appreciation to Dr. Karl Grube and Donald Bulat for acting as mentors in my early professional development in educational facility planning. And lastly, and most importantly, this book is dedicated to my wife, Jenny Anne Hill, without whom this book would never have been written. She has been a sounding board, reader, editor, friend, and personal support through its numerous drafts. The final responsibility for the content of this book is mine, although we shared in its development.

Franklin Hill, Ph.D.

ABOUT THE AUTHOR

Franklin Hill, Ph.D., has over 15 years of practical experience in education and educational facility planning. After undergraduate studies in economics and earning an urban planning degree in England, he completed his doctorate in educational administration at the University of Michigan.

He has been a teacher, administrator, and district level facility manager for one of the nation's largest urban-suburban districts in Jacksonville, Florida. He has also served as vice president of educational facility planning with an architectural firm and large construction program management company.

Dr. Hill is best known for his role in planning the Dr. Phillips High School in Orlando, Florida. In this project, he instituted significant involvement of private industries such as Walt Disney World, Sea World, NASA, and General Electric in the facility planning process.

In 1986 he was a speaker at the Edusystems 2000 World Congress on Educational Facilities held in Jerusalem, Israel and has been invited to present a paper in the Peoples Republic of China in 1989.

Now, as a national consultant based in Bellevue, Washington, his facility planning projects have spanned the United States and Canada and have included corporate electronic learning environments as well as schools. He is a member of the Council of Educational Facility Planners International.

CHAPTER SUMMARY

Chapter I: Technology Is Here!

We must stop *"planning"* for technology and *realize that technology is here!* This chapter emphasizes the purpose of this book with regard to education, the role of the school board member, and the ultimate impact of technology on the learning environment.

Chapter II: School District Self-Evaluation for Facilities and Technology

Many districts *think* they are ***"high-tech."*** Unfortunately, they may only be addressing a portion of tomorrow's instructional technology. Technology management is an important topic. The questionnaire in this chapter offers a *comprehensive perspective of instructional technology* and can serve as a planning tool for future action.

Chapter III: The Media Center: A "Bionic Heart" in an Electronic School

This chapter provides an overview of technology's impact on the learning environment in the Media Center.

Chapter IV: Making Room for Technology in Schools

This chapter provides an overview of accommodating *specific* instructional innovations in classrooms, science facilities, ITV studies, computer laboratories, and other spaces. Recommendations provide an *overview,* not design specific solutions.

Chapter V: Industry and Education: Planning for Technology Together

Industry and education can work together to plan for tomorrow's learning environment. This chapter outlines the exciting planning process used in the development of the *Dr. Phillips High School* in Orlando, Florida. The author served as facility planner for this project as Vice President for Educational Facilities with the design firm, and *included Walt Disney World, Sea World, NASA, and other industry representatives* in the planning process.

Chapter VI: Facility Master Planning: a Businesslike Approach to Educational Specifications

Educational specifications have an expanding role as tools for master planning of capital construction. Remodeling and new construction are addressed here.

Chapter VII: Program Management: Hiring Help

School districts that cannot afford hiring full-time facilities staff can turn to program management firms, architects, and engineers for help.

Chapter VIII: Miscellaneous Topics of Concern to Board Members

A survey of school board members revealed many facility issues of concern in addition to planning schools to accommodate instructional technology. This chapter addresses state's responsibiliy, cost control, selecting a design professional, re-using an existing school plan, passing a bond referendum, and change orders to construction.

APPENDICES

Appendix I	"Planning for the 21st Century" - Questionnaire used to survey school board members regarding facility planning concerns.
Appendix II	Science Facility Master Planning, Orange County Public Schools, Orlando, Florida
Appendix III	Wisdom from the Field
Appendix IV	Recommended Reading

CHAPTER I

TECHNOLOGY IS HERE !

TECHNOLOGY IS HERE!

The world is changing rapidly.

Education is changing rapidly.

The future will belong to those who can *participate in it*.

In the last 20 years, technology for education has been changing incredibly fast. We have moved from the teacher and a chalkboard to interactive video, interactive distance learning, ever-expanding levels of data access, lasers, electronic art and music, and robotics. New methods for teaching our children, or rather ***managing their learning***, abound in nearly every program area.

New technology is playing an important role in instilling in our young people the additional skills necessary to be competitive in new local, state, national, and global work places.

The rules for success are changing

The rules for success are changing!

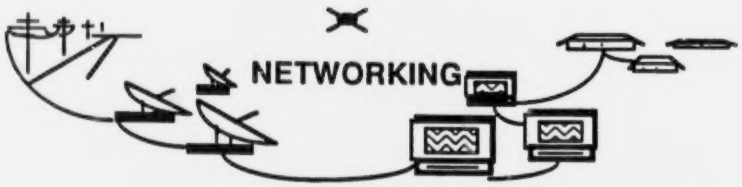
Because the world will continue to change rapidly, education cannot stop with high school or even college. Today's students will continue learning throughout their entire lifetimes.

To support lifelong learning, education is undertaking a complete transformation, with a strong emphasis on *learning how to learn*. Computer- related technology will play an important role in this learning process.

As instructional methods change, the educational environment must also change. ***Unfortunately, many school districts are building 1950's schools for the 21st Century.***

The instructional program comes first

To properly change the learning environment through new construction, remodeling, and renovation, school district leaders must first commit themselves to keeping their understanding of instructional technology up to date. Then, educational facility planning must specifically identify design requirements necessary for *cost-effective* implementation of new technology in the learning environment.



The future of education belongs to those school districts that maximize the benefits of *appropriate* new instructional innovations to support the learning process.

THE PURPOSE OF THIS BOOK

This book emphasizes the importance of *remodeling and upgrading existing schools and building new educational facilities* where new instructional technology can be cost-effectively applied. It summarizes a variety of electronic innovations recently introduced to schools and comments on their impact on educational facility design.

Policy makers, school administrators, and teachers who read this book will be empowered to take a proactive role in emphasizing the importance of building educational environments that support new learning technology.

Board members set strategic course

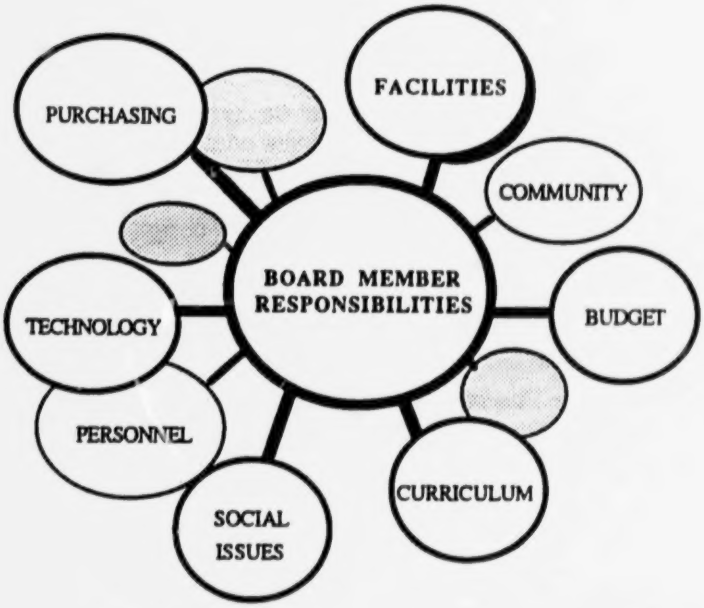
This book is intended to help school board members and policy makers set the *strategic course.* However, it is *not* intended to provide design guidelines for school administrators responsible for educational facility management. School districts must work directly with qualified educational planners and design professionals in order to create individual buildings that meet specific community needs.

Enabling the use of new instructional technology in school buildings is only one element of successful educational facility management. For this reason, this book *goes beyond technology* to address a variety of more general facility management issues of concern to policy makers. These include:

- Facility planning policies and procedures
- Project management and cost control
- Selecting and managing your architect and engineer
- Facilities personnel - staffing your own department
- The new role of educational specifications
- Technology and construction

A SPECIAL NOTE TO SCHOOL BOARD MEMBERS

School board members are policy makers who set district strategy and long-term goals and objectives. School board members often confront decisions that call for expertise they personally lack. This is particularly true in educational facility management, where major facility concerns arise infrequently and board members' experience may be particularly limited. This book is intended to help bridge this knowledge gap.


PURCHASING
FACILITIES
COMMUNITY
BOARD MEMBER RESPONSIBILITIES
TECHNOLOGY
BUDGET
PERSONNEL
CURRICULUM
SOCIAL ISSUES

FACILITIES is one of many responsibilities

It is *not* the purpose of this book to create facilities experts on any school board. *Nor* is it recommended that school board members become involved with every detail of an educational facilities construction program.

Gaining heightened awareness of the educational facilities management process, the impact of new instructional technology on that process, and the general management conditions most suitable for project efficiency and success is prudent for successful district policy leadership and should be encouraged.

In addition to being policy makers, school board members play many other important roles, all of which directly or indirectly affect educational facilities.

EDUCATORS

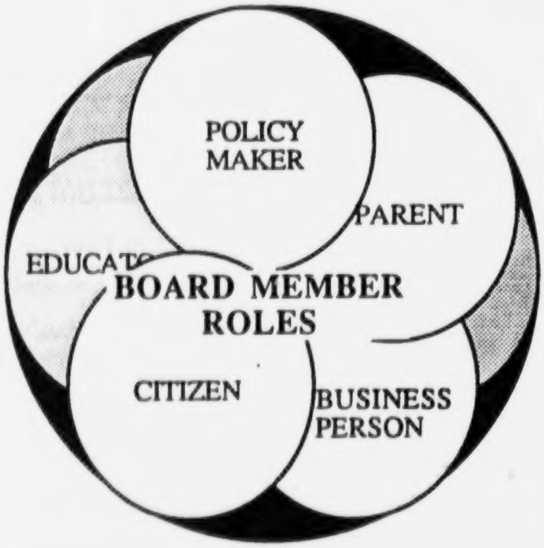
As *concerned educators*, school board members want educational staff to manage our children's learning as effectively as possible. They must demand that educational facilities create an environment conducive to this end.

CITIZENS

As *concerned citizens*, school board members may want to give adults in the community access to instructional programs. Thus, they frequently encourage community use of our schools. Again, our educational facilities must be planned and designed for safe community access during evening and weekend periods.

EMPLOYERS

As *employers*, school board members realize that the demand for adult retraining is expanding. The potential for applying new instructional technology to training should be considered in every educational building program.



PARENTS

As *concerned parents*, school board members want the best learning environment for *all* our children. This dictates safety in the planning of computer centers to avoid screen glare, which can result in eye strain and impair sight. It also dictates safe practices in the design and implementation of instructional technology support equipment in vocational centers. Finally, it demands safe and environmentally stimulating classrooms for exceptional students, art and music programs, and even physical education - *all of which are impacted by new instructional technology*.

BUSINESS PEOPLE

Finally, as *business people,* school board members want to remain constantly aware of their elected responsibilities to citizens as taxpayers. Thus, they must feel confident that their decisions for tomorrow's education and tomorrow's educational facilities are thoroughly evaluated, well planned, and implemented *cost effectively.*

This book addresses these and other facility management concerns - concerns that are important to a policy maker, citizen, educator, parent, and business person.

TOMORROW IS HERE!

All too often, education leaders believe it is sufficient to *"plan for tomorrow."*

At the very least, planning is not enough. At the worst, it can become a convenient means of avoiding issues and deferring action.

> TECHNOLOGY IS **ALREADY HERE**!
>
> IT IS IN MANY OF OUR SCHOOLS! IT IS CONTINUING TO EXPAND AT A TREMENDOUS RATE.
>
> WE CANNOT AND MUST NOT CONTINUE TO JUST "PLAN."
>
> **WE MUST ACT!**

The "technology train" is ***not*** approaching the station and allowing us time to arrive and board at a leisurely pace. Rather, it is on its way to the next destination at an ever-increasing speed.

We must decide to act. Of course, we must act in an informed, logical, and cost-effective manner. But we must act to define our future educational programs and then clearly define the new learning environment necessary to effectively support those programs. And we must not forget the all-important step of training staff to work to their full potential in that new environment.

Knowing where you are going depends on knowing where you are.

To help you understand your school's or district's present condition with regard to technology education programs, a self-evaluation questionnaire is included in Chapter II.

CHAPTER II

SCHOOL DISTRICT SELF-EVALUATION FOR FACILITIES AND TECHNOLOGY

SCHOOL DISTRICT SELF-EVALUATION FOR FACILITIES AND TECHNOLOGY

Technology in the classroom goes far beyond the use of computers. A broad variety of electronic innovations is affecting *every* instructional program from pre-school through high school, not to mention colleges and universities. Even administrative areas are undergoing a technology revolution and private sector corporations are using interactive videodiscs and telecommunications to create degree-level university courses for specialized training of personnel.

Successful educational institutions are strategically planning their facilities with today's and tomorrow's electronic program requirements in mind.

THE "TECHNOLOGY ELEPHANT"

We all remember the story of the description of an elephant as relayed by a series of blind men. The one touching the trunk described the elephant as a snake-like creature. The one with his arms wrapped around a leg described the elephant as something like a tree. The person holding onto the tail pictured the elephant as a furry creature and not very large. Each had his own perception based on his own frame of reference.

The whole technology picture is hard to define

The issue of technology as it applies to education and educational facilities is similar to describing the elephant. School districts that have installed a computer laboratory or one computer per classroom may feel they have "described the technology elephant." Districts that have engaged in distance learning may likewise believe they have successfully addressed the potential of new instructional technology.

It is necessary to step back and focus your vision on the *entire* technology elephant, or at least on what that elephant *looks like today*.

TECHNOLOGY MANAGEMENT

Technology management structures the orderly, cost effective, and educationally valid use of technology in the educational setting. Technology management *responds* to the instructional program by selecting and using technology that will successfully supplement classroom and administrative activities, thus enhancing the educational process. *As always, well -defined educational program goals must come first.* Technology supplements those goals efficiently and cost effectively.

Manage technology!

If technology leads, the results can be a piecemeal and disjointed collection of gadgetry. It may look good in the local paper, but may not allow effective educational progress into the 21st Century.

Don't let technology manage you!

Technology management examines classroom needs. It must also strategically examine technology in specialty areas such as the media center, administration/guidance, the arts, custodial equipment, energy management, and even building construction systems such as roofs.

Successful technology management ensures that each step toward technology use (as small as it may be) supports an educationally appropriate and definable goal. Only when educational goals are well defined and technology is selected to support those goals can a successful learning environment be planned and designed. If we believe that "form follows function," then the form of the learning environment must respond to the instructional program and the technology that supports it.

An outline of the planning process, including technology management and facility design, is provided below.

FACILITY MANAGEMENT SEQUENCE

A typical planning and management sequence is provided below. It integrates educational goals with technology management and facility design.

Goals: Create well-defined goal statements for the entire school district as well as each part, including instructional programs, administrative functions, and support services.

Objectives: Define clearly and in measurable terms the outcomes to be accomplished by each part of the educational program.

Technology Management: Evaluate which technology types can *best* meet the district's goals and objectives. Define precisely the type and extent of technology to be used. Look at the "big picture." Cluster common technology types where appropriate to improve efficiency and save money.

Consider testing your proposed technology in an existing classroom or administration area before turning it over to the design team. *Work out the "bugs" in advance.* Visit existing applications in education or industry, and judge their successes carefully. *Make sure it really works!* Time well spent in the beginning can save money and improve design communication.

Technology Schematic Plan: Develop a specific schematic diagram which illistrates *all* networking requirements - within the individual classroom, between classrooms, between departments, between buildings, and with distant sources.

Define Facility Needs: Define the learning environment based on the instructional program goals, activities, and technology applications. This is the role of educational specifications (see Chapter VI).

Evaluate Existing Buildings: Thoroughly evaluate existing buildings to determine their adequacy for accomplishing the district's educational goals and particularly the goals for technology. Understand clearly the conditions of each construction system and their future life-cycle costs for continued use.

Develop Facility Master Plans: Develop district-wide and building-level master plans that consider future enrollments, programs, new construction/remodeling, budget, and schedule (see Chapter VI).

Project Design: Select your planning and design team carefully. Participate in the process. Several chapters in this book address this important topic.

Project Construction: Project construction must be monitored carefully. Several chapters also address this issue.

Post-Occupancy Evaluation: After the building is built, *test it*. See if it meets the program and technology objectives. *Document strengths and weaknesses so improvements can be made in future projects.*

FACILITIES TECHNOLOGY SURVEY

To gain a general understanding of school board members' concerns with regard to new instructional technology and its impact on educational facilities, the author sent a questionnaire in 1987 to approximately 125 school board members representing school districts in Florida, North Carolina and Virginia. Approximately 100 questionnaires were returned.

The survey was intended to elicit comments on educational conditions with regard to technology, educational facility concerns, and *any other issues* that might be addressed by a publication of this type.

A copy of the survey questionnaire is provided as Appendix I. Some of the most important findings were that school board members:

- Are not fully aware of the diversity of instructional technology applications
- Are not certain that their facilities representatives and/or architects are experts in curriculum and new instructional technology
- Need *specific descriptions of new instructional technology* and related facility design requirements to help them visualize "tomorrow's learning environment"
- Feel that construction costs must remain well managed while school districts design facilities to accommodate new instructional technology
- Need background knowledge in how to select an architect, maintain project schedules, and minimize change orders
- Perceive a great need for training administrators and staff in the use of instructional technology after technology is planned and designed correctly into a building
- Feel that contracted facility management services should be discussed as an alternative to short-term employment of facilities personnel.

FACILITIES TECHNOLOGY QUESTIONNAIRE

✓LIST

The questionnaire on the following pages is provided as a "facilities technology check list" for self-evaluation. It is *not* a scientifically developed research instrument. The values assigned to each category are ***not*** survey research tested -- although they can help district personnel estimate the status of their facilities and technology plans.

The intent of the instrument is to increase general awareness of technology developing in K - 12 education and encourage thinking about the potential facility implications.

This questionnaire may be used as:

1. A general overview of technology and facility planning as they apply to any school district. Each item addressed in this questionnaire *is presently used* by a school district and/or state department of education.

2. A starting point for developing a *strategy for technology*. In other words, it may assist in "planning" the technology planning process.

3. A starting point for developing strategy for a particular technology application. (For example, it can point out community, district, building, and classroom needs to be addressed in a master plan for computer networking.)

4. A report completed by district staff for the benefit of a school board member.

   (Should this be the case, an actual review of a few existing master plans may be enlightening. For example, it could be helpful to mention *specific space standards* for a kindergarten classroom and/or media center currently used in your school district, the method used in developing those standards, and whether those standards are applied for all construction -- including remodeling.)

Using the questionnaire can give a school district perspective on present status, future direction, and facility needs.

FACILITIES AND TECHNOLOGY QUESTIONNAIRE

The following questionnaire is intended to help school districts create a *status report* on instructional technology and facilities planning, and in turn to help them strategize for the future.

The questionnaire has three levels of evaluation:

- **+2 = strong active program presently underway**
- **+1 = evaluation and strategic planning underway, but not complete**
- **0 = no action planned or anticipated at this time**

The questionnaire is divided into two parts:

- **Technology and facility planning = 60 possible points**
- **Facility management = 60 possible points**

TECHNOLOGY AND FACILTY PLANNING

		+2	+1	0
1.	Has a **staff position** been established for instructional technology? (4 points times score)			
2.	Has a strategic district-wide plan been developed for **computer-aided instruction?**			
3.	Has a comprehensive **networking schematic plan** been prepared for all connective technology?			
4.	Has a strategic plan been developed for **the placement of computers in facilities?**			

	+2	+1	0
5. Has a **strategic technology master plan** been prepared for:			
A. Building-wide instructional television?			
B. Computer laboratories in each school?			
C. Computer laboratory networking?			
D. Individual classroom computer/video instruction?			
E. Building-wide computer networking?			
F. Instructional television support technology?			
G. Media center information networking?			
H. Media center community use plan with distance access?			
I. Media center ITV network?			
J. Media center checkout/inventory technology?			
K. Computer-aided instruction for exceptional education?			
L. Administration/guidance computer network?			
M. Science laboratory networking?			
N. Science technology support equipment?			
O. Core subject computer applications (English, math, etc.)?			
P. Business education technology?			
Q. Technology education in vocational programs?			
R. District-wide distance learning technology?			
T. Adult continuing education?			

	+2	+1	0
6. Is there a plan for **home/school data link?**			
7. Is there a computerized district-wide student information system and record-keeping system tied to each school?			
8. Is there a district-wide connectivity plan for integrated computer communications?			
9. Is there a district-wide **instructional television plan?**			
TOTAL FOR TECHNOLOGY & FACILITY PLANNING			

WHAT YOUR SCORE MEANS

50 - 60 Your school district is on a very successful road to the 21st century. Most of your technology is underway. Be careful to monitor accomplishments and schedules.

To enable the author to follow your progress, please send him a copy of your questionnaire at 13421 N.E. 47 Street, Bellevue, Washington 98005 with a contact person's name, phone number, and address.

40 - 50 Your district could be well on the way. You should have at least one technology coordinator. Monitor accomplishments of programs underway. Determine realistic time-lines for implementing outstanding programs. Publish successful programs and define needs to the community for further support.

30 - 40 You are off to a good start. Some programs are underway, but most of the effort is probably in planning. Set realistic time frames for implementation. Check successes and failures to improve future planning. Check previous budgets and schedules to further improve planning. Funding may be a problem. Consider going to the public with the plan, budget, and schedule. Have community involvement in the planning process and needs assessment.

Under 30 Hire a technology coordinator and establish a budget for training that person. Develop a plan of information collection, visitations, and conference attendance. Develop a library of areas investigated. Start inservice training to get others (including the community) on the bandwagon. Begin with building-wide ITV, computer networking, science, and the media center.

FACILITY MANAGEMENT

		+2	+1	0
1.	Is there a **district-wide facility plan** for new construction and remodeling?			
2.	Has the master plan been professionally **cost estimated?**			
3.	Is there a **district-wide inventory** of educational facilities, including:			
	A. School site sizes?			
	B. Classroom listings/sizes?			
	C. Support spaces listings and sizes?			
	D. Enrollment capacity ?			
	E. Energy efficiency data?			
	F. Dates of building construction?			
	G. Mechanical systems identification?			
	H. Roofing system profile (date, type, maintence)?			
	I. Total building area (NSF and GSF)?			
	J. Building plans?			
	K. Site plans?			

		+2	+1	0
4.	Do facility staff members have practical teaching experience?			
5.	Has facility personnel received training in curriculum and instructional technology?			
6.	Does your district use valid space standards in building planning?			
7.	Do space standards provide specific size allocations for each instructional program, support space, and ancillary space?			
8.	Are **educational specifications** prepared for each new construction or remodeling project?			
9.	Do educational specifications provide detailed analysis of existing building conditions and systems?			
10.	Do your educational specifications provide budget and scope-of-work information?			
11.	Are staff and administration involved in the facility planning process?			
12.	Are educational specifications prepared by a properly trained planning professional?			
13.	Is the community involved in the facility planning process?			
14.	Are local industries and their technological experts involved in the facility planning process?			
15.	Is there a **district-wide master plan** for facility technology?			
16.	Are specific space standards and design standards established for each instructional technology?			

		+2	+1	0
17.	Is there state funding of district capital construction?			
18.	Is there a state department of educational facilities?			
19.	Is value engineering part of your standard plan review?			
20.	Is your facility planning person a member of the Council of Educational Facility Planners International or another facility planning group?			
	TOTAL FOR FACILITY MANAGEMENT			

50 - 60 Your district is fortunate to be among the most progressive in the country. Focus your attention on technology in your facility planning. Give incentives to schools with creative ideas.

40 - 50 Your district may be undertaking a major construction or renovation program and may realize how much information is required. Consider using computerized data bases to help. If you are remodeling, be sure to master plan each campus as part of a district-wide strategy. Estimate construction costs accurately before you ask voters for help; you may get only one chance.

20 - 40 Your's may be a district where funding is limited and projects are undertaken on an as-need basis. As technology advances and educational needs grow, increased pressure will be placed on facilities. Begin to define the organizational structure, existing building condition database, and design requirements for technology. If some schools get better technology treatment than others, it will be obvious and community problems may develop.

10 - 20 You may be in serious trouble. If funding is an issue, consider lobbying for a state-directed system of planning and funding educational facilities. Equal educational opportunity is a state responsibility. Use consultants in your planning process to save dollars and get a national perspective on technology.

CHAPTER III

THE MEDIA CENTER: A "BIONIC HEART" IN AN ELECTRONIC SCHOOL

THE MEDIA CENTER: A "BIONIC HEART" IN AN ELECTRONIC SCHOOL

It has been said that libraries will soon become "museums for books." Don't believe it!

Others say the media center is the "heart of the school."

That's more like it!

222
MEDIA CENTER
OF
TOMORROW

If so, tomorrow's media center will be a **"bionic heart"** in an electronic learning environment.

Tomorrow's media center will have many functions, each with its own technology requirements.

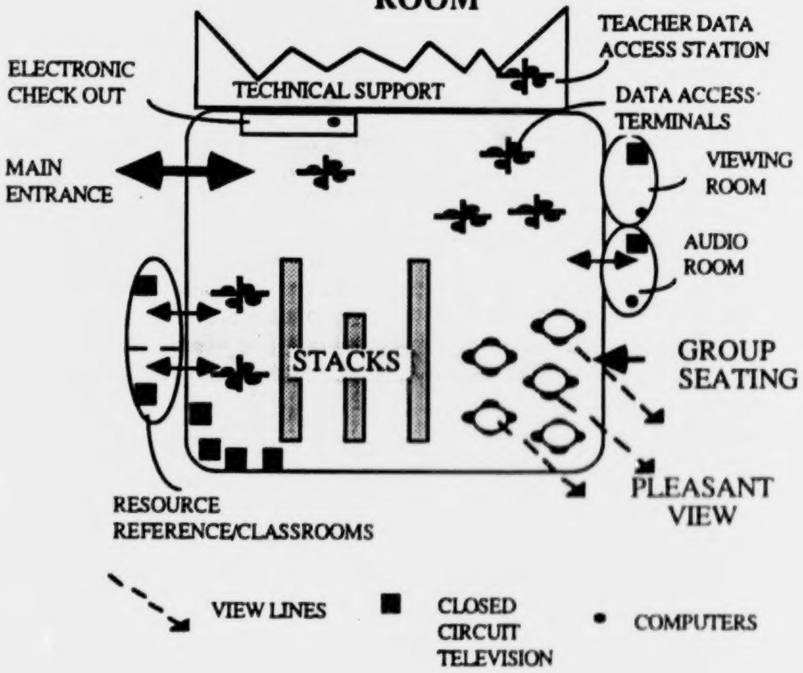
But, be careful, we must not plan just for the technology. *We must also plan the environment that will maximize learning effectiveness.*

Let's take a walk through the media center and place various currently available electronic aides in their proper ***"learning environment."***

READING ROOM/STACKS

Computers access numerous databases from floppy disks, optical discs, building-wide sources, and distant sources (district, national, and global) in the media center's reading room.

CONCEPTUAL READING ROOM


TEACHER DATA ACCESS STATION
ELECTRONIC CHECK OUT
TECHNICAL SUPPORT
DATA ACCESS TERMINALS
MAIN ENTRANCE
VIEWING ROOM
AUDIO ROOM
STACKS
GROUP SEATING
PLEASANT VIEW
RESOURCE REFERENCE/CLASSROOMS
VIEW LINES
CLOSED CIRCUIT TELEVISION
COMPUTERS

Avoid television and computer screen glare

Low ambient light over computer work areas reduces screen glare and lessens eye strain. Computer screens are positioned *away from outside windows and other bright light sources* that would direct light into users' eyes. (Remember, cameras don't take good pictures into the sun, and neither will the human eye.) *Light gray and soft pastel wall and carpet colors in computer areas reduce anxiety and eye fatigue.*

INSTRUCTIONAL VIDEO

Instructional television occupies several zones within the reading room/stacks. Networked to a centralized distribution system, students can check out instructional videotapes and videodiscs from the front desk and have programs channeled to small television sets, such as those found in airport terminals, in their study carrels. If no such network is available, students use the video resources at stand-alone players and monitors.

Sound-directed speakers and earphones minimize disruptions to others. As with the computer screen, video screens are carefully oriented in relation to outside windows, overhead light, and ambient light. Screen orientation also allows privacy for the user who may be embarrassed by a video on a health-related topic or other sensitive subject.

Computer locations and electrical outlets in the reading room have been carefully planned to avoid covering the floor with extension cords.

REFERENCE AREAS

Standing-height work stations make walk-up access to the electronic card catalog easy and space efficient. Side tables allow for note taking and placement of personal belongings.

Of course the check-out counter is computerized

Of course, the check-out counter is computerized as well. A computer in the director's office is networked to the counter computer. As with the other screens in the media center, the important issues of screen orientation to avoid glare and eye strain are considered here. Librarians are people too!

TEACHER WORK AREA

Professional staff work areas -- common in more recently built media centers -- are networked to the district-wide student management system for transfer of attendance, student records, grades, and electronic mail. Even students' homes can be brought into this network.

NETWORKING

CONFERENCE ROOMS

Permanently installed television screens are carefully oriented in relation to surrounding light sources and away from entry doors. Wall-mounted units save floor space.

Directional speakers pointed toward the viewing public and a sound-proof wall immediately adjacent to the wall-mounted surface avoid disruption of neighboring spaces. Speakers are located away from movable partitions or room dividers, if they exist.

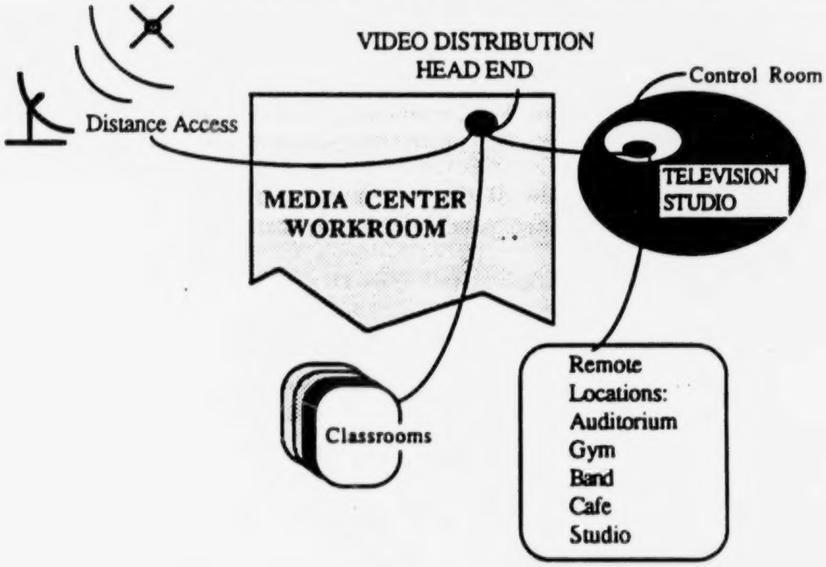
Cameras' orientations to outside light, the spectrum of overhead and spot lights, texture and color of surrounding wall services, and mechanical system duct placement have been planned to avoid disruption of transmissions.

CLOSED CIRCUIT TELEVISION

The television studio is located *away from outside noise sources, such as heavy-traffic hallways*. Mechanical system disruptions are engineered out by orienting air vents away from speakers, baffling duct work to avoid hissing sounds, positioning the studio away from facility mechanical rooms, providing for dirt filtration, and so on. Space is available for expanding support equipment in the production area for distance access, video and sound editing, and building-wide distribution of the morning news.

Placement of video distribution in the media workroom rather than in the television studio enables easy supervision by the media director.

CONCEPTUAL
INSTRUCTIONAL TELEVISION PLAN


VIDEO DISTRIBUTION
HEAD END
Control Room
Distance Access
MEDIA CENTER
WORKROOM
TELEVISION
STUDIO
Classrooms
Remote
Locations:
Auditorium
Gym
Band
Cafe
Studio

Most of all, the television studio is a learning environment *designed to enhance instruction,* not simply to produce media products. Observation windows, small group instructional needs, and even access for tardy students without disruption "on the set" have been carefully considered.

SECURITY

This *"heart of gold"* media center requires an effective security system. Orientation of outside doors, evening lighting, windows, and internal circulation are planned with security in mind.

Building design, however, is only one aspect of security. Internal management systems, issuance of keys, and staff use promote prudent property management. Equipment is regularly inventoried.

COMMUNITY USE

The media center *"heart goes out to the public"*.

The community has helped to plan a media center that will meet its needs for adult education and retraining. Interactive video and other electronic learning methods enable enhanced professional development and career change.

Parking lot lighting, entrance lighting, and even landscaping promote a safe and *"welcoming"* evening out of the house.

THE BOOKS

Finally, books are a very important part of the media center. They are a great "communication system" with an established track record. They don't require extension cords, they never "erase" at the wrong time, and they fit nicely into pockets for the bus ride home.

Will the library be a "museum for books?" Never! A bionic heart for tomorrow's electronic learning? ***Absolutely yes!***

CHAPTER IV

MAKING ROOM FOR TECHNOLOGY IN SCHOOLS

MAKING ROOM FOR TECHNOLOGY IN SCHOOLS

Many people consider new instructional technology to be little more than computers used to drill students in math times tables or other rote learning.

Drilling as the primary function of computer-aided instruction is an extremely narrow view of the impact that new technology is having on education.

This chapter will provide several specific examples of instructional technology and the impact it is having on selected instructional programs in kindergarten through high school. The program areas include:

- Elementary classrooms
- Middle school electronic neighborhoods
- Science facilities
- Instructional television
- Accommodating computer workstations
- Electrical service planning
- Furniture for technology
- Heating and air conditioning
- Building-wide technology planning

This chapter is intended to present to school board members and administrators a sampling of important instructional technology and related design implications. It is not intended to be an all-encompassing design guideline or solution for updating school districts. Nor is it intended to create facility planners out of school board members.

The State of Florida is nationally recognized as having well-developed space standards for all instructional spaces -- kindergarten through university. Florida uses these standards for district-wide master planning, determination of educational facility need, allocation of state funds, educational specification preparation, and design plan review. Space allocations in this chapter use the Florida standards - Administrative Code 6A-2.

ELEMENTARY CLASSROOMS

Planning elementary-level facilities that will accommodate new instructional technology requires consideration of all instructional and support spaces, from classrooms to the exceptional education center, media center, art room, music room, physical education areas, and the school office.

Among the technological innovations that are changing the shape of elementary instruction are:

- Computer applications such as word processing
- Computer-aided instruction
- Interactive and non-interactive videodisc, CD-ROM, and videotape
- Two-way interactive and one-way instructional television
- Telecommunications such as electronic mail and electronic information services
- Home-based data access for students and parents
- Robotics

Teachers are using computer workstations for learning management and administrative duties, including:

- Development of individual educational programs (IEPs) based on individual students abilities and learning styles
- Attendance
- Grading
- Electronic Mail (within building, district, community)

In addition to having an area for computer-aided instruction, a typical primary classroom will include the more *traditional functions,* including:

- Small group instruction (Reading, math, etc.)
- Multi-media work area (Recorders, listening equipment,)
- Small group "quiet" reading
- Small group wet area for art and science
- "Quiet time"
- Cooking/baking area (kindergarten)
- Storage (Student, bulk, and classroom)

Accepted Functions and Space Standards

The following functions and their related space standards have been developed and used in planning *kindergarten, primary, and intermediate classrooms* in the State of Florida.

Educational space standards are only a guideline. Each school district must evaluate space standards in terms of its individual programs, needs, and funding.

GENERAL CLASSROOM FOR GRADES K - 6

PROGRAM FACILITY SPACE*	NUMBER OF OCCUPANTS PLANNED	NET CLASSROOM SQUARE FEET			RELATED SUPPORT SPACES
		Min.	Norm.	Max.	
Kindergarten Classrooms	25	900	950	1000	P-5 R-1 S-1 U-8 C-1
Classrooms grades 1 - 3	25	900	950	1000	P-4 S-1 U-8 C-1
Classrooms grades 4 - 6	30	900	960	1020	P-4 S-1 C-1
Resource Room K - 6	15	450	480	510	P-5 C-1
PLUS THE FOLLOWING SUPPORT SPACE ALLOCATIONS:					
P-4 Material Storage	n/a	70	75	80	
P-5 Material Storage	n/a	95	100	105	
R-1 Outside Storage	n/a	45	50	55	
S-1 Student Storage	n/a	25	30	35	
U-8 Student Toilet (in classroom)	n/a	25	28	30	
C-1 Computer work area	n/a	15/computer			

Space standards refer to Administrative Code 6A-2 as published by the State of Florida. C-1 is an allocation for pupils per computer developed by the author.

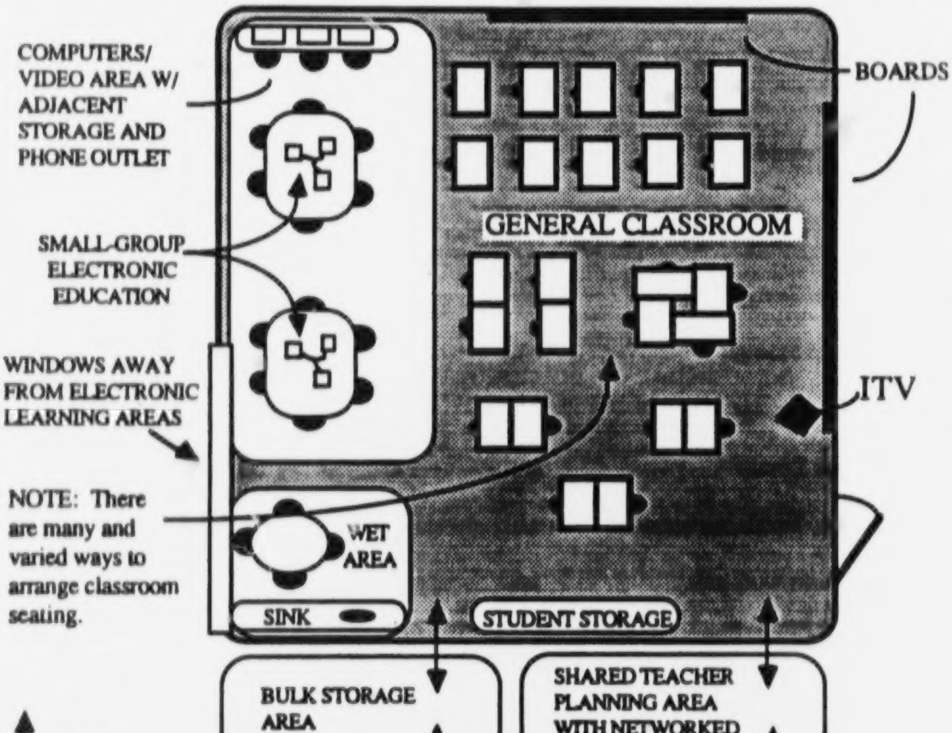
*Teacher Planning area not included

Prototype Elementary Classroom

The diagram below pictures several acceptable planning relationships for a self-contained elementary classroom arrangement, including:

- Definition of large group instructional area
- Definition of small group instructional area
- Integration of multi-media and computerized small group instruction
- Orientation to outside lighting to reduce screen glare
- Orientation to doors and windows to reduce vandalism and improve security

CONCEPTUAL ELEMENTARY CLASSROOM


COMPUTERS/ VIDEO AREA W/ ADJACENT STORAGE AND PHONE OUTLET
BOARDS
GENERAL CLASSROOM
SMALL-GROUP ELECTRONIC EDUCATION
WINDOWS AWAY FROM ELECTRONIC LEARNING AREAS
ITV
NOTE: There are many and varied ways to arrange classroom seating.
WET AREA
SINK
STUDENT STORAGE
BULK STORAGE AREA
SHARED TEACHER PLANNING AREA WITH NETWORKED DATA ACCESS
= DOOR
ADJACENT CLASSROOM

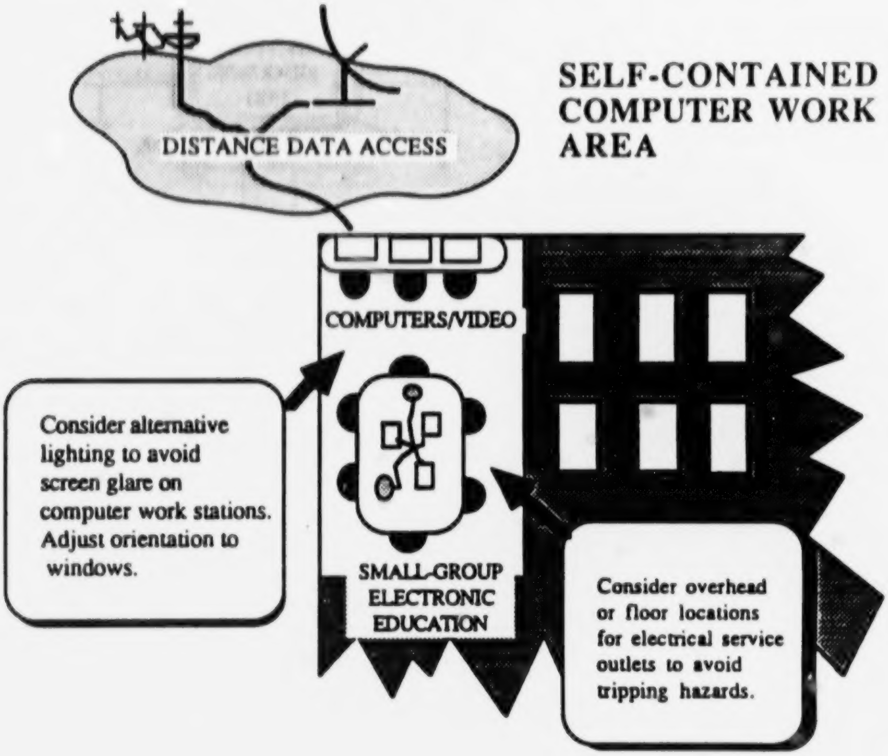
Classroom Computer Work Areas

Computer-aided instruction and interactive video learning may be combined in one multi-media small group instructional area in elementary classrooms. The configuration will also support middle and secondary configurations.

Several environmental issues to be considered include:

- Location of computers away from windows
- Separate lighting -- with lower foot candle levels -- for computer work stations
- Electrical surge protection
- Adequate electrical service in outlets and at the panel for future needs
- Classroom networking/building-wide networking

The following illustration highlights planning issues related to combining computer work stations and the traditional small group media work table in a traditional self-contained classroom.



SELF-CONTAINED COMPUTER WORK AREA

Consider alternative lighting to avoid screen glare on computer work stations. Adjust orientation to windows.

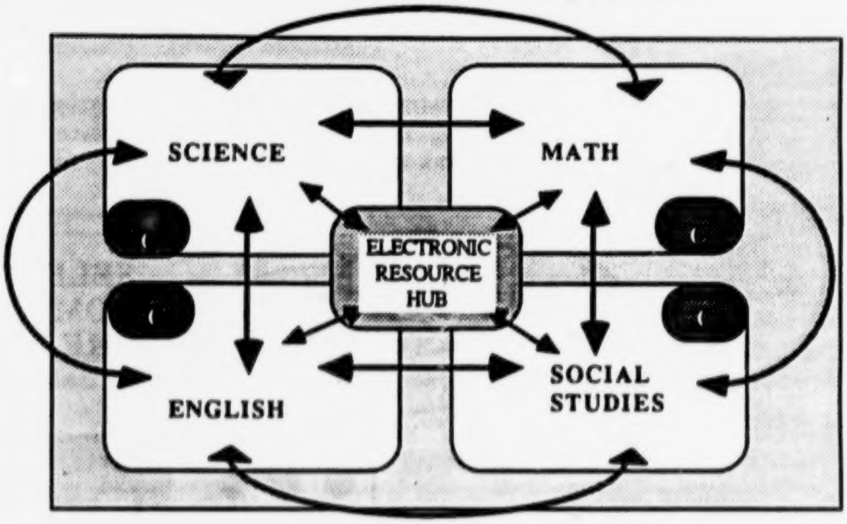
Consider overhead or floor locations for electrical service outlets to avoid tripping hazards.

MIDDLE SCHOOL ELECTRONIC NEIGHBORHOODS

In the middle school grades, several programs can be clustered around a common data access area to encourage holistic learning. This allows sharing of computers, videodiscs, CD-ROM discs, and distance data access terminals.

The following illustration combines social studies, English, science, and math in an "instructional neighborhood" concept. Students within the neighborhood will share the same teachers. In this manner, the English and social studies teachers can develop common strategies for individualized instruction. Math and science can do the same. Computer-aided instruction can be jointly selected to address mutual learning objectives.

HOLISTIC EDUCATION



The electronic learning center provides shared resources which are economical and maximize use. Note the importance of sound separation with windows for observation. *Access is not through the electronic resource hub.*

Some computers remain in the classroom for individualized work projects.

Special Considerations and Questions

1. Does your district have space standards for kindergarten, primary, and intermediate level facilities?
2. Have the technology issues discussed in this section been considered in planning your elementary-level educational facilities?

44

SCIENCE FACILITIES

New instructional technology is having acute effects in secondary science classrooms and laboratories. Space requirements are changing in:

- Chemistry
- Biology
- Physics
- General science
- Marine biology
- Technical support areas

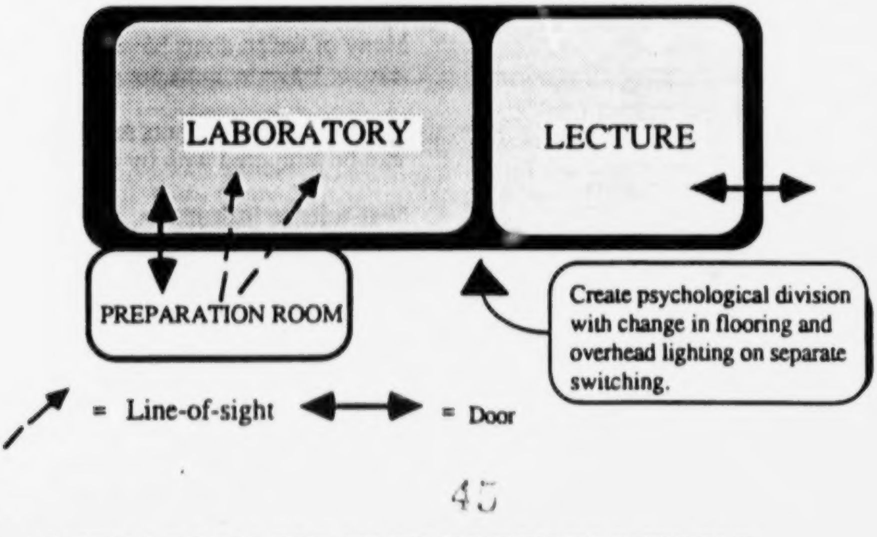
This does not even begin to address new science and vocational programs in:

- Robotics
- Microelectronics
- Microbiology
- Space science
- Laser studies
- Computer Science

Lecture/Laboratory Separation

Science facilities are frequently planned to divide lecture and laboratory activities, usually in the same room.

LECTURE / LABORATORY ARRANGEMENT



Create psychological division with change in flooring and overhead lighting on separate switching.

There are several functional strengths associated with this arrangement:

- Students are clustered during lecture activities and large group instruction, improving instructional focus and student attention
- Line-of-sight distance to the screen or blackboard and other visual aids is minimized
- Lecture areas can be scheduled by non-science programs if necessary in order to maximize building utilization
- Distractions found in the laboratory area are removed from temptation until necessary for instruction
- Laboratory experiments can be set up several periods in advance without disruption by other classes

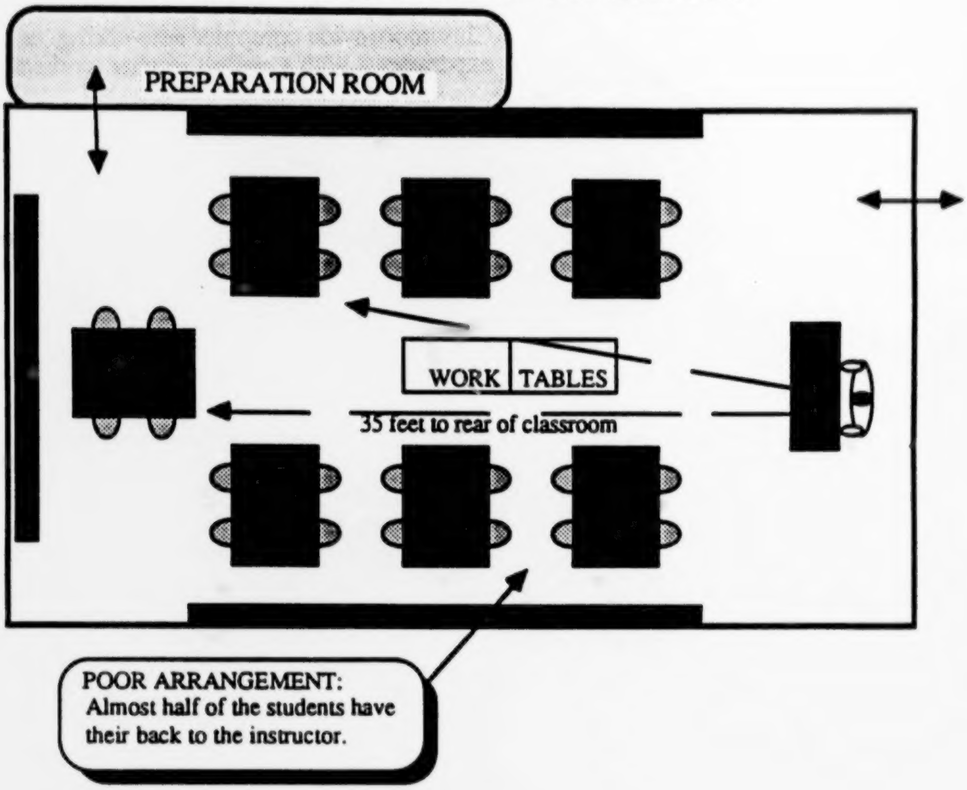
Traditional Science Classroom Configuration

Traditionally, science classrooms are combined with the laboratory area. Students will conduct lecture instruction at the science "lab" table.

Drawbacks to this arrangement include:

- Students are spread out over a longer distance from the teacher
- Many of the students have their backs to the teacher when lectures are presented
- Laboratory experiments set up in advance can be tampered with by other classes
- Non-science instruction, such as math, English, or social studies, is difficult to carry out in a laboratory-focused classroom arrangement (should scheduling require non-science use).

TRADITIONAL LABORATORY CLASSROOM


PREPARATION ROOM
WORK
TABLES
35 feet to rear of classroom

POOR ARRANGEMENT:
Almost half of the students have their back to the instructor.

Science Technology Examples

New instructional technology is impacting high school science programs in the following areas:

- Computerized data collection, analysis, and modeling for experimentation, using videodisc, CD-ROM, and floppy disk equipment

- Sophisticated support equipment including laser systems, electron microscopes, and simulation equipment
- Classroom-wide computer networking of laboratory experiments with a central teacher workstation
- Computerized technical support -- such as lasers, temperature probes, and electron microscopes -- in laboratory preparation rooms
- Instructional video that enlarges live or taped laboratory experimentation and microscopic analysis
- Interactive videodisc in lecture or laboratory areas
- Distance learning for college prep, college credit, and -- sometimes in small and rural school districts -- basic instruction

Well-defined and increasingly complex laboratory activities are enhancing today's science instruction. Many states are mandating minimum instructional program requirements for laboratory activities.

It can be assumed that laboratory-related training will be an increasingly important component of the science instructional program.

Accepted Functions and Space Standards

The following functions and their related space standards have been developed and used for the planning of science facilities in many states, including Washington, California, Texas, and Florida.

CLASSROOM AND LABORATORIES FOR GRADES 9-12

PROGRAM FACILITY SPACE*	NUMBER OF OCCUPANTS PLANNED	NET CLASSROOM SQUARE FEET Min.	Norm.	Max.	RELATED SUPPORT SPACES
General Classroom	*30	750	810	870	P-4, C-1
Resource Room	15	450	480	510	P-5
Science Demonstration Classroom	30	1050	1110	1170	P-7, C-1
Science Laboratory (General, Biology, Physics, Chemistry)	*24	1150	1225	1395	P-7, R-5, C-1

PLUS THE FOLLOWING SUPPORT SPACE ALLOCATIONS.

		Min.	Norm.	Max.
C-1	Computer work area	10	12	15/computer
P-4	Material Storage	75	75	80
P-5	Material Storage	95	100	105
P-7	Material Storage	140	150	160
R-5	Project Storage	165	175	185

Space standards refer to Administrative Code 6A-2 as published by the State of Florida. C-1 is an allocation for pupils per computer developed by the author.

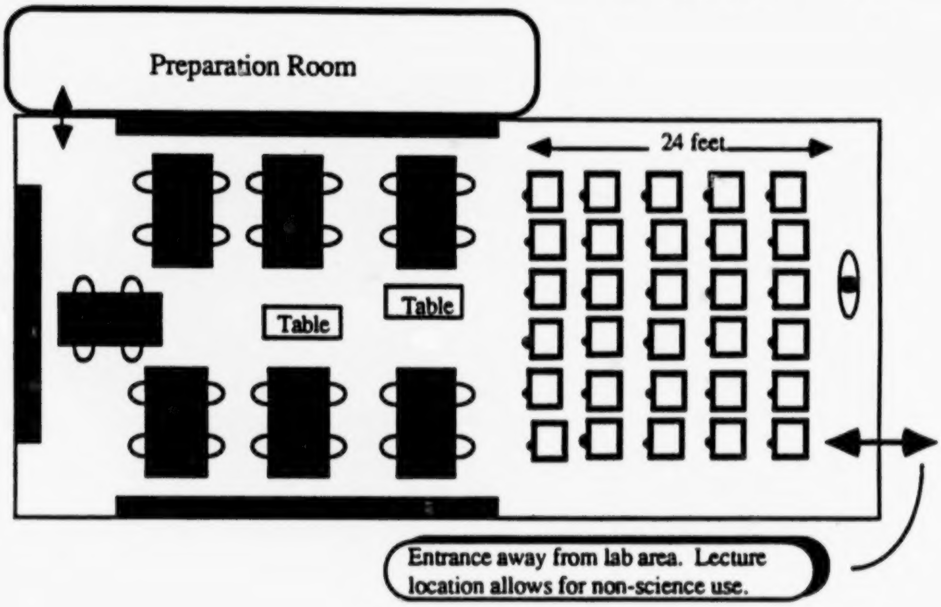
*Teacher Planning area not included

Prototype Science Classroom

A prototype science classroom is described below. It demonstrates several acceptable planning practices for chemistry classroom function, including:

- Separation of lecture and laboratory functions
- 28 lab stations
- Adjacent observable preparation room

LABORATORY ARRANGEMENT



Entrance away from lab area. Lecture location allows for non-science use.

Science Laboratory Work Station

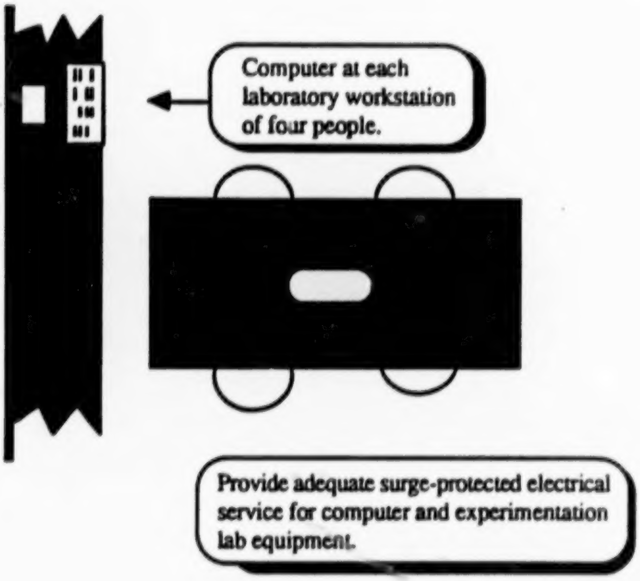
Issues important to computer-aided instruction and computer modeling of science experiments at lab stations include:

- Location and space allocation for computers
- Safety in electrical service design (considering proximity to water)
- Corrosion protection of electrical equipment
- Electrical surge protection

- Computer networking (classroom, lab, building, distance access, etc.)
- Security
- Lighting to avoid screen glare

The illustration below shows a computer next to a traditional laboratory workstation.

SIMPLIFIED LAB/COMPUTER WORK STATION



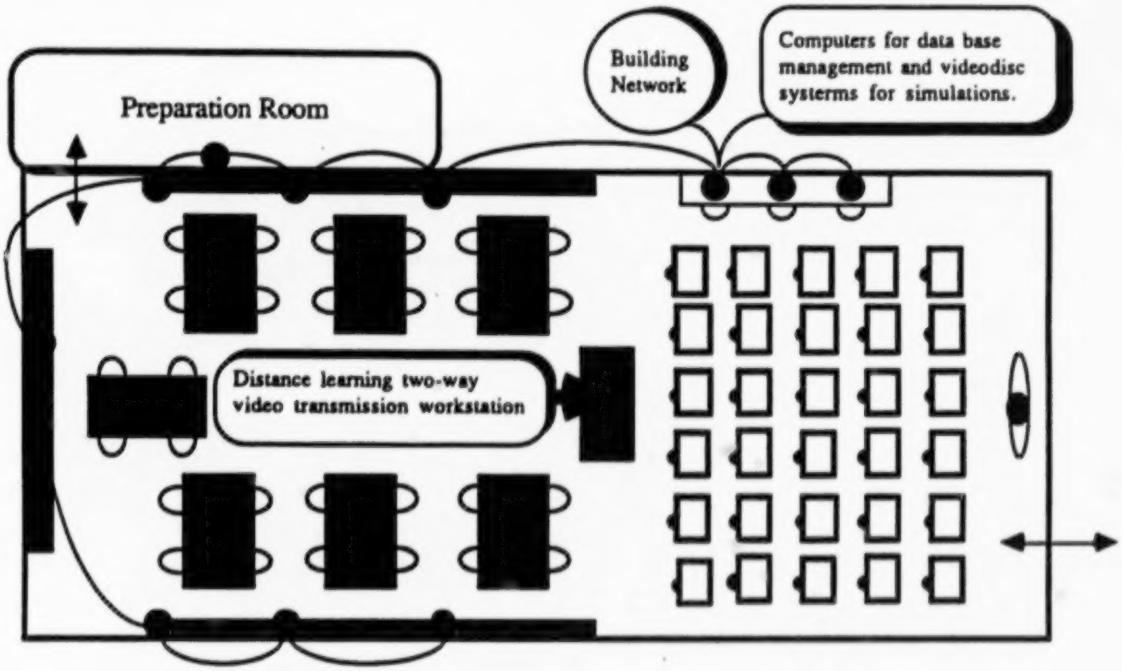
Computer at each laboratory workstation of four people.

Provide adequate surge-protected electrical service for computer and experimentation lab equipment.

The individual lab station is part of a classroom and building-wide networking plan that includes:

- Computer modeling
- Distance data access
- Interactive video instruction
- Video enlargement/taping

NETWORKED LABORATORY ARRANGEMENT / VIDEO

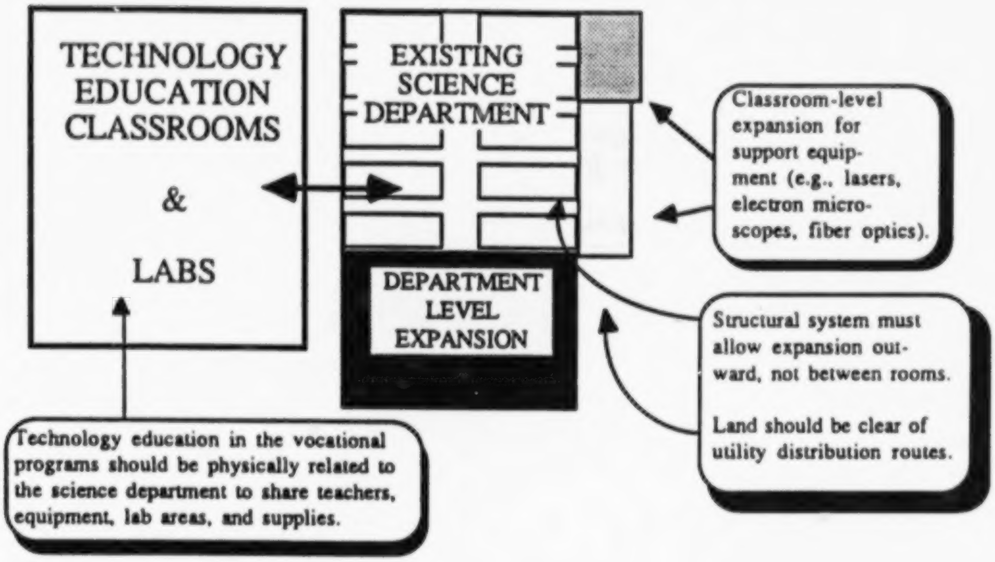

Preparation Room
Building Network
Computers for data base management and videodisc systerms for simulations.
Distance learning two-way video transmission workstation

Science Department Expansion

The entire science department must be designed for potential expansion, so that future technology can be accommodated. Issues related to this expansion include:

- site allocation for future expansion
- primary electrical service allocation
- structural system selection
- orientation to existing laboratory areas

SCIENCE DEPARTMENT EXPANSION


TECHNOLOGY EDUCATION CLASSROOMS & LABS
EXISTING SCIENCE DEPARTMENT
DEPARTMENT LEVEL EXPANSION
Classroom-level expansion for support equipment (e.g., lasers, electron microscopes, fiber optics).
Structural system must allow expansion outward, not between rooms.
Land should be clear of utility distribution routes.
Technology education in the vocational programs should be physically related to the science department to share teachers, equipment, lab areas, and supplies.

Notice that technology education classrooms and laboratories should be located near the science department to allow shared use of laboratory facilities that might not otherwise be affordable to either department.

Special Considerations and Questions

1. Does your district have space standards for science facilities?

2. How do your space standards compare to the examples provided above?

3. Is space allocated for expanded computer use in both the lecture and laboratory areas of instructional space?
4. Have the technology issues discussed in this section been considered in the planning and educational specifications for your science facilities?

5. Do your educational specifications functionally describe technology requirements in specific architectural and engineering terms (e.g. lighting, electrical service, and networking)?

The solution proposed above does not address details of ventilation, lighting, solar orientation, security, safety-to-life, and other important issues related to science department planning.Numerous, highly technical requirements are important per specific scientific disciplines. *Each has its own instructional technology implications.*

Appendix 2 highlights the district planning activities of the Orange County (Florida) Public Schools as conducted by the author. This planning project remodeled more than 150 science classrooms in nine high schools. This sample planning project had a system-wide master plan, system-wide budget, prototype laboratory solution, and phased implementation plan.

INSTRUCTIONAL TELEVISION

Whether it relies on broadcast, microwave, satellite, fiber optic, cable or other form of delivery, and whether it's based in a television studio, multi-purpose room, or specially equipped classroom, instructional television is having an impact on nearly every educational space, *from kindergarten through 12th grade.* It is enhancing classroom instruction, physical education, vocational education, media center activities, and even use of schools by their communities.

Teachers are using video as an integral part of the learning process, asking students to document science experiments with video footage, videotaping students to help them improve speech, drama and music skills, and using on-screen teachers to present concepts to their classes.

Broadcasts and cablecasts of world events are used as the video component of cross-curriculum lesson plans based on real-world happenings.

Accepted Functions and Space Standards

The following functions and their related space standards have been developed by the state of Florida, and have been used for planning in such states as Washington, Texas, and California.

CCTV STUDIO SPACE ALLOCATIONS

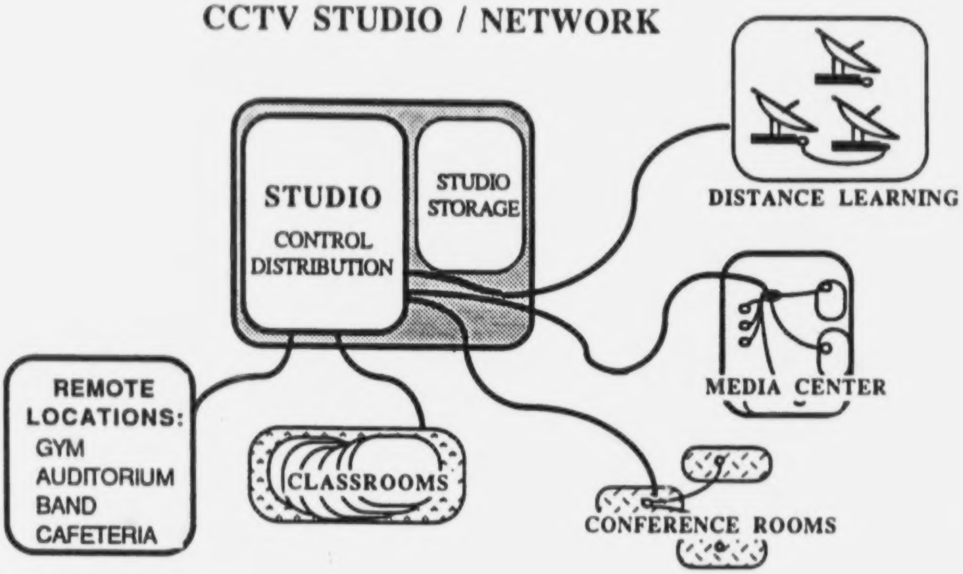
PROGRAM FACILITY SPACE*	NUMBER OF OCCUPANTS PLANNED	NET CLASSROOM SQUARE FEET Min.	Norm.	Max.
Closed Circuit Television Studio (Production, Distribution, and Control Room Storage)	10% school capacity**	6	7	8
Closed Circuit Television Studio Storage	10% school capacity	4	4.5	5

Space standards refer to Administrative Code 6A-2 as published by the State of Florida.
*Teacher Planning area not included
** Ten percent of the building capacity is used as the basis for determining studio size. It is assumed that the larger the school, the more studio use will occur. A school of 1600 students would require a normal studio size of 160 X 7 or 1120 net square feet.

New instructional technology will impact closed circuit television studio design and (CCTV) networking in the following areas:

- Space allocation for TV studio and support equipment
- Flexible planning of CCTV studio area
- CCTV distribution to media center locations
- CCTV distribution to pre-determined conference locations
- Distribution of CCTV to pre-determined classroom areas
- Interactive video
- Distance learning

CCTV STUDIO / NETWORK


STUDIO
CONTROL
DISTRIBUTION
STUDIO STORAGE
DISTANCE LEARNING
MEDIA CENTER
REMOTE LOCATIONS:
GYM
AUDITORIUM
BAND
CAFETERIA
CLASSROOMS
CONFERENCE ROOMS

Prototype CCTV Studio

Any CCTV design solution should include several acceptable planning practices, including:

- Appropriate *relationships* between the studio, production room storage, and student access
- Appropriate production room *lighting*
- Production room *flexibility* for adding additional support equipment for such functions as editing and sound dubbing
- *Acoustical design*
- Appropriate *expansion opportunities* designed into all areas

Special Considerations and Questions

1. Does your school district have a master plan for instructional television?
2. Do your middle and high school facilities have predetermined spaces set aside for a CCTV studio?
3. Are students encouraged to use video equipment in

preparing instructional materials for classroom presentations?

4. Does a master plan for security exist for instructional television equipment?

5. Do your educational specifications functionally describe technical requirements in specific architectural and engineering terms?

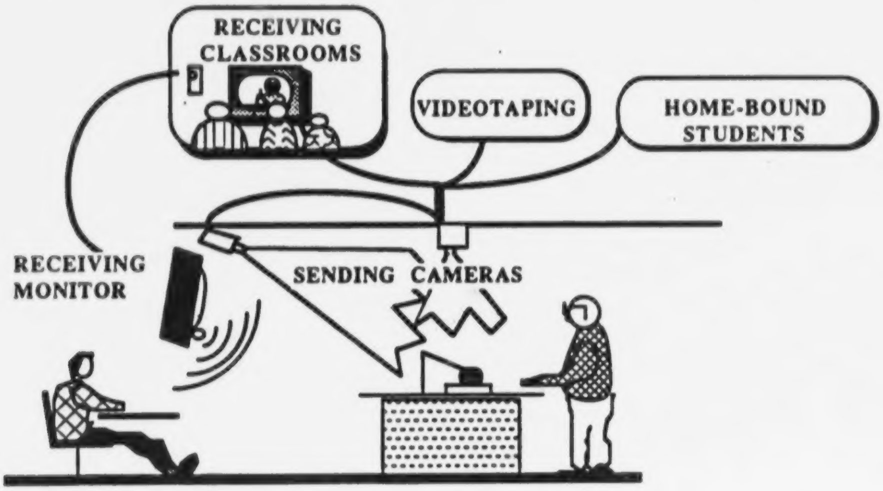
Two-way Video and Distance Learning

Frequently, specialized courses cannot be taught because qualified teachers are not available to the school district. Likewise, specialized teachers may not teach an advanced course because of low student enrollments. Two-way interactive video can bring students and teacher together over great distances.

Courses suitable for interactive two-way video include advanced science, math, specialized foreign languages, and selected college credit courses.

A science laboratory can be upgraded to provide this distance learning opportunity. The illustration below shows a section of a laboratory, two-way interactive teaching station, and related networking requirements.

DISTANCE LEARNING AND INTERACTIVE TELEVISION



ACCOMMODATING COMPUTER WORK STATIONS

The advent of the computer is the single most revolutionary addition to the classroom, media center, administrative suite, science laboratory, teachers' work room, and almost any other part of the school. Successful planning for this technology depends on three key elements:

- Lighting to avoid screen glare
- Adequate space for computer and printer
- Appropriate electrical service

Lighting to Avoid Screen Glare

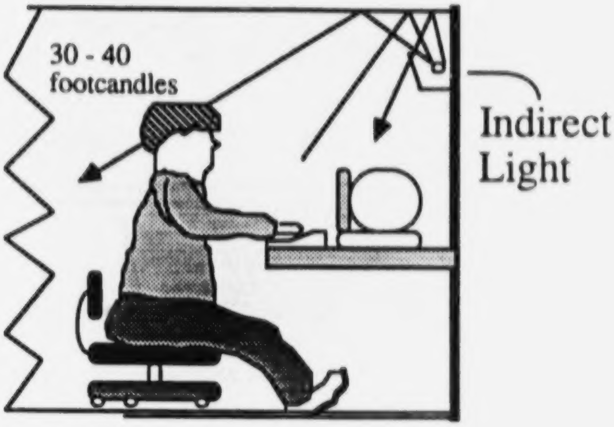
The successful placement and use of a computer workstations depends largely on lighting design for proper:

- Light intensity
- Surrounding light sources (overhead, behind screen, and behind user)

Significant research is underway related to the proper intensities of light surrounding a computer work area. A range of 30 to 40 foot candles is suggested by the Illuminating Engineering Society (IES). It is recommended that the light source be indirect and reflected off a surface such as the ceiling or wall.

Indirect, even lighting "washes" the subject and reduces bright spots. The wave length and color can pick up the tone of the surface on which it is reflected. The picture below illustrates the concept of indirect lighting.

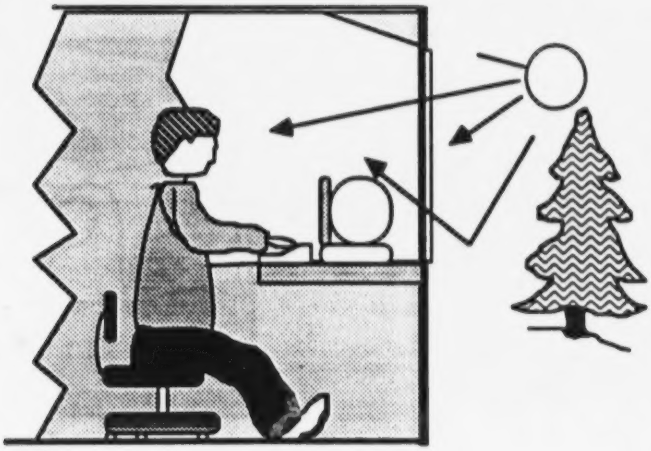
INDIRECT LIGHTING



Light sources surrounding the computer work station are the most common causes of screen glare. They are commonly found behind the computer, over the head of the user, or behind the user.

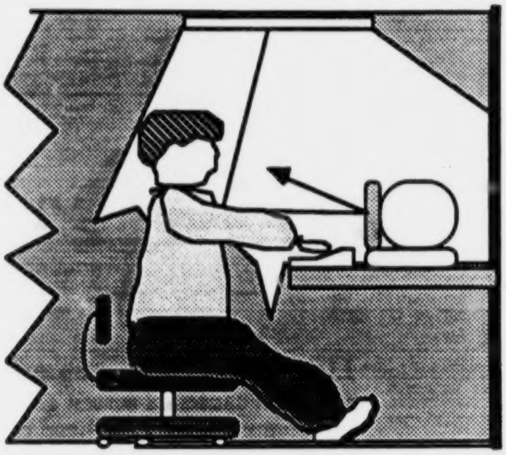
A strong light source behind the computer may shine into the computer operator's eyes. The user tries to look through the bright light to see the screen. This is a common problem when the computer backs up to a window.

DIRECT FRONT LIGHT



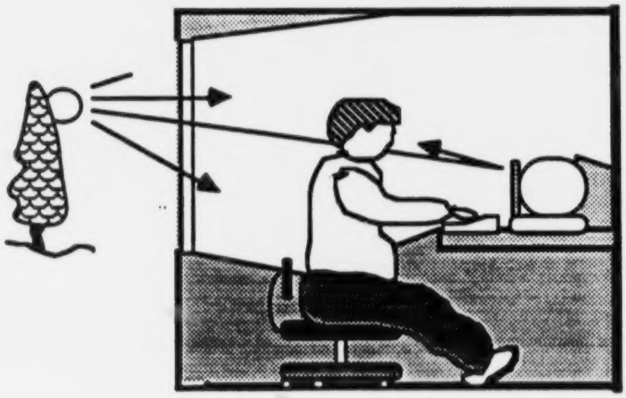
Bright overhead lighting or spot lighting causes indirect glare, usually from the body of the computer operator. This is most common if the user is wearing light-colored clothing, which reflects light into the screen. Although spot lighting seems less intense overall, the bright spot actually increases the glare problem.

DIRECT OVERHEAD LIGHT



Light behind the user will reflect directly into the screen and create light spots. The user will move his or her head back and forth in an attempt to get the proper angle to the text and avoid the "white spots." Rear lighting can be from a window, an overhead source, or a wall-mounted light fixture.

DIRECT REAR LIGHT



Computer Work Area

Computers, printers, and the necessary furniture require extra space in the classroom. Plan to allow 8 to 10 square feet for each workstation. A classroom planned for 30 students might be served by 875 square feet including storage, averaging about 29 square feet per student. Adding three computer workstations and a printer in a corner of the room would bring total square footage to between 900 and 915 square feet.

ELECTRICAL SERVICE PLANNING

Electrical service planning and placement requires special attention to the functional requirements of space. In the past, it was adequate to specify one or two outlets per wall or one outlet every 8 or 10 feet. This is no longer the case.

Computer work areas must be well defined based on the program objectives of the course or educational space. Numbers of students, whether they will share stations, and networking requirements must be well-established in advance.

Placement of electrical outlets must be based on an understanding of the glare issues discussed earlier in this section. Since the engineer designing the electrical outlets may not be the same person locating the overhead lighting, goals must be *well defined* and *translated clearly* to the engineering team.

Surge protection avoids power increases which can be detrimental to computers and erase data. Reductions in electric current can be equally detrimental. Electrical paneling must be planned with this in mind. Avoid sharing computer work areas with electrical service to the shop, maintenance area, or wall outlets in the hallways where vacuums and buffers may be used during school hours.

FURNITURE FOR TECHNOLOGY

For building design to work well, it must compliment the function and the furniture of the space. Educational specifications have an important role in defining both elements before design begins (See Chapter VI). A few of the areas to consider are:

Computers: Identify the cabinets which work best for your environment and identify them in the educational specifications. Include a catalog cut which pictures the equipment as well as gives the dimensions. Know in advance if you intend to include a printer with each computer, as this impacts electrical service. If students will simultaneously use books, papers, and other references, so advise the architect so spacing between units can be properly allocated.

Technology Education: Technology education is changing. Many programs rely on self-contained mobile cabinets for equipment storage. Consider this equipment in advance of design. Spacing of electrical outlets (wall, floor, or ceiling) may change. Door widths may need adjustments. Again, include a catalog cut within educational specifications.

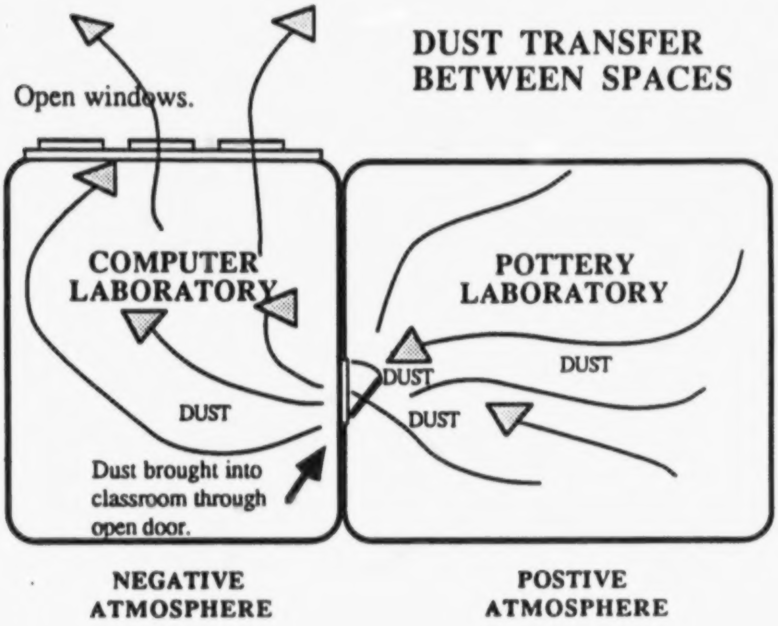
Lasers & holograms: Consider size, weight, and security in placing these units. Many laser tables are sand based and very heavy in order to reduce vibration. Structural systems and floor coverings should be planned accordingly. Plan doors, windows, and weekend access with security in mind.

HEATING AND AIR CONDITIONING

Placing furniture and technology equipment in the way of heating and air condition ducts is obviously not good judgement. It can damage the equipment and reduce the efficiency of the mechanical systems.

First, be sure the design team (particularly the engineer) is aware of the equipment and technology layout for each space before design is completed. Second, train personnel in the placement and operation of this furniture and equipment after the building is built . *Many spaces do not work because the user does not understand the logic behind the design*

Dust can be very harmful to technology equipment. Currently, districts are moving away from chalkboards for this reason. Dust transfer, because of the mechanical system, can still be a problem. Address concerns for dust in technology spaces in the educational specifications. Alert the architect that different air pressures (atmospheres) can cause air to move from one room to another and take dust with it. Be careful that technology rooms (particularly near pottery classes, wood shops, and other dust generators) do not ventilate or draft air and dust toward equipment.


DUST TRANSFER BETWEEN SPACES
Open windows.
COMPUTER LABORATORY
POTTERY LABORATORY
DUST
DUST
DUST
DUST
Dust brought into classroom through open door.
NEGATIVE ATMOSPHERE
POSTIVE ATMOSPHERE

BUILDING-WIDE TECHNOLOGY PLANNING

Many issues are important to successful building-wide technology planning, including structural system selection and orientation for expansion. One good first step is the establishment of a building-wide networking plan that will become the basis for a conduit or cable tray locations.

Begin with a clearly defined building-wide technology plan which includes immediate and long-term computer purchases. Define connectivity requirements and quantities and types of cable needed. Include video, telephone, and computer needs in your plan. Think carefully about the distribution once the cable enters the classroom, administrative suite, or media center.

Planning for technology is not simply running conduit everywhere!

CHAPTER V

INDUSTRY & EDUCATION:

PLANNING FOR TECHNOLOGY TOGETHER

INDUSTRY & EDUCATION: PLANNING TOMORROW'S TECHNOLOGY TOGETHER

Imagine your child sitting in a classroom designed with the help of *Walt Disney World, Sea World, General Electric, NASA, the Florida Solar Energy Center, and three major communication companies*. This is the exciting opportunity afforded to the students of Orange County Public Schools located in and around Orlando, Florida.

Walt Disney World

Sea World

NASA

General Electric

WFTV - Orlando

Few school districts are fortunate enough to have world famous corporations available and willing to participate in a construction program. But fortunately, technology is changing the face of almost every industry in every part of the country. Even in the smallest communities, astounding applications are in use. Banks, fast food restaurants, print shops, the newspaper, a TV station, or a local cattle farm may *already be part of the future*.

This chapter outlines how Orange County included industry in its process of identifying and planning for new instructional technology in education and facility design. It also points out how other school districts can apply a partnership strategy. Look around you, the future may be closer than you might think.

General Electric

WFTV - Orlando

CENTRAL FLORIDA DEMOGRAPHICS

Central Florida is one of the nation's fastest growing areas. Major corporations have found it an opportune place to relocate. Some have referred to Orlando, Florida, as the *"Silicon Valley"* of the southeastern United States. "Florida is becoming increasingly important as a bellwether state and may soon surpass California," according to John Naisbitt, author of Megatrends.

In addition to high-technology industries, Central Florida is a well-known center for leisure and recreation activities, attracting the public to the facilities of corporations such as:

- Walt Disney World
- Sea World
- Epcot Center
- Kennedy Space Center
- Wet 'n Wild

The area's major technology corporations include:

- AT&T
- Martin Marietta
- General Electric
- Harcourt, Brace, Jovanovich
- Stromberg Carlson

THE CHALLENGE

Be flexible for tomorrow's technology

When the Orange County School Board decided to build a new high school, it recognized Central Florida's trend toward a technology-intensive economy and the challenge that high technology placed on the area's educational institutions. The board set the following educational goal:

> "Build a school to meet *today's* instructional programs, while being *flexible enough to incorporate the technology of the 21st century.*"

The final result was the new $30 million Dr. Phillips High School, built to serve 2,500 students. This facility has become known as the *"Educational City of the Future."*

NOTE: The author was vice president of educational facilities with one of the Dr. Phillips High School's design firms, served as facility planner throughout the project, and is credited with creating the industry and education workshop presented in this chapter.

PRE-PLANNING EDUCATIONAL SPECIFICATIONS

Orange County's school board began planning for this project with the development of educational specifications that defined all the facility's educational components.

Educational specifications are not enough

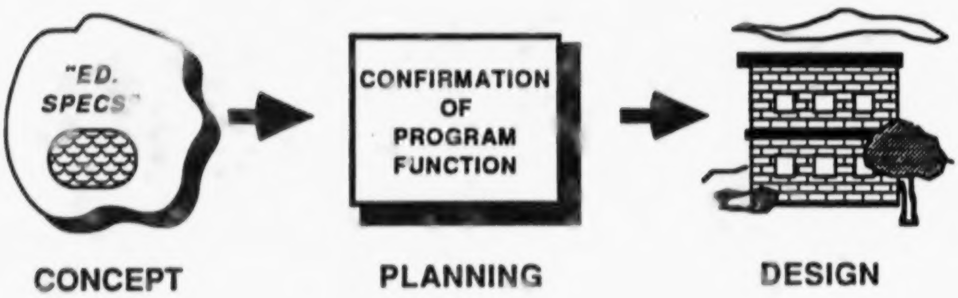
More than 24 instructional programs were identified for this school. Each program was outlined with regard to necessary square footage, instructional program goals, and furniture requirements. The resulting document was a comprehensive menu and checklist identifying the initial scope of work for architecture and design services.

The educational specifications document is frequently the primary or only means of communication between the client (school board) and the design team (architect, engineer, and other service contractors). But the Orange County School Board and its design team had significant further involvement.

Confirm and update the instructional program

The *entire* educational specifications document was reviewed, confirmed, and updated on a program-by-program basis by the architectural firm's educational facility planner and district staff members representing each instructional program. The facility planner then developed architecturally valid functional relationships among educational programs with the architects and engineers.

Next, the facility planner, educational program representatives, and architects made site visits to nine local and regional high schools. Existing facilities, however, could not offer many good design examples for a 21st-century school. Thus, Orange County turned to the surrounding high-tech community for new instructional technology applications.



APPROACHING INDUSTRY PARTNERS

Seeking industry participation, the Orange County School Superintendent sent a letter directly to the presidents of selected local companies, stating the school district's goals for its new high school -- particularly in terms of technology use -- and asking the presidents to send appropriate company representatives to a half-day workshop with school district representatives and members of the design team.

The school district kept in mind the corporate sector's productivity consciousness, planning the education/business partnership to make efficient use of time, talent, and conviction on both sides of the table. Advance information was thorough enough that some company representatives came to the workshop armed with brochures, research papers, and photographs that were highly useful in Orange County's planning process.

Industries participating in the workshop included:

Walt Disney World

Sea World

NASA

The Florida Solar Energy Center

WFTV Channel 9

WWTV Channel 24 (PBS)

The Orlando Sentinel Newspaper

THE WORKSHOP

The half-day workshop brought the business representatives together with the school district's facility planning team: representatives of educational programs, the architectural firm, and the facility planner. The planner set three goals for the meeting:

Communication: to open lines of communication between corporate leaders, the school board, and the planning team.

Commitment: to establish a solid industry commitment to the successful planning and design of the 21st-century educational facility. This commitment was not to be financial, but was to involve industry opening its doors and sharing its technological expertise with the educational and facility planning team.

Site visits: to schedule visits to industry sites, where the facility planning team could observe the impact that advancing technology has in the corporate sector and consider the impact it will have in education. By observing how existing buildings have succeeded or failed to accommodate new technology, the planning team believed it could design guidelines for flexibility in the educational environment.

Workshop participants represented diverse professional backgrounds: industry, education, planning, and design. It was essential at the start to focus on the element common to all. To achieve this focus, the facility planner posed the following question:

> "If your children were to attend this new high school, what technological advancements are you aware of in your business or profession that would make them excited about learning and challenged about their future?"

SITE VISITS

At the business/education workshop, each corporation was paired with a particular instructional program, setting the stage for ensuing site visits. Representatives of the instructional programs, together with the facility planner and appropriate design professionals, visited the matching corporations.

Not all technology is good for the learning environment

Participants in these site visits quickly observed that it would be inappropriate to simply copy industry's technology applications. Any technology should be applied to education only in so far as it enhances learning objectives. Not all technology is good for the learning environment.

Each of the visits with industry is summarized below. Note that the purpose of each visit was geared *specifically to the educational needs of the Orange County Public Schools*. The results may not be suitable or appropriate to other educational situations.

WALT DISNEY WORLD

The visit to Walt Disney World focused on technology used in:

- Horticulture
- Food services
- Computer information systems

Horticulture

The Land Pavilion associated with Walt Disney World's EPCOT Center is an outstanding application of horticulture and its future technology applications.

Technology impacts many ***vocational*** *programs*

Instructional staff examined detailed requirements such as solar orientation of greenhouses, climate control equipment, the relationship of work spaces to horticulture activities, space requirements, and even work tables most appropriate to maximizing plant growth.

All these details could apply to the high school horticulture program, if such a program were desired and affordable.

Food Services

Walt Disney World is well known for its food services operation. More than 2 million people travel through the EPCOT and Walt Disney World facilities annually. The ability to efficiently serve properly prepared food is critical to the success of this entertainment industry.

Various innovations in food preparation, many of them typical of fast-food and large bulk-food preparation businesses, have been adapted and included in the Walt Disney World complex.

Instructional staff determined that, if properly designed, educational facilities for exceptional students in food preparation would allow employment access to a growing and thriving local industry and "real work" opportunities.

As a result of this visit, space for the new high school's exceptional education program was re-designed from a residential kitchen and "home-like" environment to a commercial food preparation setting for cooking and baking. The instructional space is adjacent to the outdoor eating area and near the cafeteria, allowing students to prepare cookies and other baked goods for fund raising projects during lunch time and before and after school hours.

The involvement of industry in planning facility needs for the exceptional education program illustrates several important issues, including:

- Examining present programs for their educational suitability
- Scaling the instructional program to *realistic* high school learning objectives
- Recognizing relationships of instructional programs to other building-wide activities
- Working closely with instructional staff and realizing the leadership role they *must* play in the educational planning process

Computer Information Systems

Technology impacts lighting

Instructional staff examined computer information systems with regard to options for computer networking and design elements that create an optimum computer laboratory environment. This research enabled a strategic design for ceiling lighting, indirect lighting, and and light intensities (foot candles*) suitable to an *electronic* learning environment.

---

* Foot candle levels refer to light level intensity. Each light and/or light fixture has a foot candle rating. These levels, however, are adjusted to the distance from the light fixture to the work surface. Foot candle levels can be measured through equipment and instrumentation typically available to the electrical engineer.

SEA WORLD

Technology impacts windows and plumbing

Sea World Corporation, one of the largest marine biology institutions in the world, can boast of renowned international experts in salt water and fresh water aquarium planning and design. Although the scale of the marine biology application found in this industry far exceeds high school programs, numerous specific environmental design guidelines could be equated to high school applications.

Accommodating the technology used in marine biology -- such as by orienting aquariums to sunlight and compensating for salt water corrosion of metal piping -- creates design issues, such as the appropriate size and location of windows and size/type of plumbing. More importantly, however, district personnel were impressed with the importance of "doing the basics well."

Working with Sea World illustrated the importance of correctly applying standardly accepted design practices .

Marine biology planning issues included, but were not limited to:

- Providing correct solar orientation of outside windows to anticipated aquarium locations with consideration of the effect direct sunlight can have on the balance of chemicals and other environmental factors
- Consideration of centralized systems for water and air that can significantly enhance marine biology laboratories

An important facility management requirement became clear during the work session with Sea World:

> *It is essential that the design engineer be appropriately involved in visits to industry sites.*

Involve the engineer in planning

First-hand discussion of design issues between industry representatives and the person who will actually make it happen in the building improves communication within the educational planning and engineering design team.

Engineers should generally be more involved than they currently are in educational planning, particularly where new instructional technology is involved.

As a result of Sea World's involvement in the planning process, Sea World has "adopted" Dr. Phillips High School as its local marine biology school. Students in the marine biology program make regular visits to Sea World's marine biology facilities.

Interestingly, as a result of the Sea World visit, the Dr. Phillips marine biology classroom now maintains over 2,000 gallons of salt water aquariums in a space that was originally considered for only several stacked fresh water aquariums.

GENERAL ELECTRIC

The visit to General Electric highlighted the importance of robotics and vision systems as *tomorrow's career fields*. Many employment opportunities will be available for properly trained vocational school graduates.

Although current vocational programs at Dr. Phillips High School are traditional programs such as wood shop, auto mechanics, and machine shop, the facility design allows cost-effective conversion to robotics, computer laboratories, and other more high-tech career areas.

The planning and design of the building accommodates what is happening today as well as what will happen tomorrow.

Today's technology impacts ***vocational education***

Although commercially applied high-technology robotics may not be a typical high school program, robotics training is a fine tool for computer instruction, computer programming, and training in mathematics and physics. *Robotics applications are already included in many elementary and junior high school educational programs.*

NASA

NASA's involvement in the planning process was particularly interesting for two reasons.

First, it highlighted the important fact that once-unaffordable laboratory equipment has become far less expensive and may soon be part of the standard high school curriculum.

The sky is not the limit

For example, an electron microscope that once cost hundreds of thousands of dollars can now be acquired for $2,500. This means that many school districts will be able to offer broader curricula in chemistry, physics, and biology programs that may require a variety of new pieces of equipment.

High school science facilities *must be designed for a variety of new "mini laboratories"* that will include a mix of heretofore unaffordable laboratory equipment. Educational facility planning and design must include strategic flexibility for building expandability, site planning, structural system flexibility, electrical service re-distribution, and more.

The second lesson of the NASA visit was realization of the importance of scientific experiments in a weightless space environment.

Although experimentation in a weightless environment can be extremely complex and sophisticated, it can also include down-to-earth experimentation typical of a high school setting.

As a result of this visit, informal communication channels were opened for new high-school-appropriate experiments based on land or aboard an orbiting space shuttle. Satellite communication between Dr. Phillips and other high schools in Orange County was also discussed as a means of networking information.

THE FLORIDA SOLAR ENERGY CENTER

The Florida Solar Energy Center was originally involved in the industry and education planning activity because the district was considering solar hot water heating as an energy conservation measure.

Technology impacts the building

The campus was originally planned for complete solar hot water heating -- including food service areas, gymnasium/shower areas, and science laboratories. This extensive solar heating package was anticipated as a result of a State of Florida mandate to provide solar heating as an alternative to other heating sources *where economically appropriate*.

As part of the energy analysis, a detailed economic feasibility study was prepared. Because of the size of the school and the quantity of hot water needed, the study did not justify solar hot water heating.

Nevertheless, involvement of the Florida Solar Energy Center grew far beyond examination of solar hot water heating systems and provided new *opportunities to examine the entire facility plan for optimizing natural ventilation and conserving energy* .

The 360,000-square-foot facility was replicated in a scale model approximately 5 feet long, 2 feet wide, and 6 inches tall. This model was wind tested at the Florida Solar Energy Center for natural ventilation and design efficiency.

Technology impacts construction cost control

As a result, the planning and design team simplified roof design -- saving more than $350,000 in construction costs -- and selected materials that reflect the Florida sun away from the building and pedestrian walk areas.

The Center did the wind test study and photography as a community service -- at no cost to the Orange County Public Schools.

WFTV CHANNEL 9 and WWTV CHANNEL 24

Instructional television (ITV) is expanding greatly as a learning tool. In addition to its application for instruction in the classroom, many middle school and high school facilities are including special areas for sophisticated television studios where transmissions can be produced and students can be trained to use equipment.

Technology impacts ***instructional television***

WFTV Channel 9 and WWTV Channel 24 (PBS), both of Orlando, Florida, provided assistance in strategically planning for existing and future television use.

Planning and design issues discussed in relation to instructional television included:

- Size and orientation of television studio
- Size and orientation of technical support spaces
- Acoustical treatment and sound separation requirements
- Student access and separate storeroom access
- Security
- Student instruction and the need for classroom observability

Television equipment is expensive. To maintain cost control, planning of the instructional television area must be done with a realistic view of construction costs.

Facility planning that allows for phased expansion of ITV equipment is the preferred and most economical solution for most school districts.

THE ORLANDO SENTINEL NEWSPAPER

The Orlando Sentinel Newspaper visit provided many recommendations for the proper planning and placement of word processing systems and information systems in classrooms and other work areas to avoid screen glare, enhance security, and provide for networking requirements.

Information Management is increasingly important to both industry and education. Planners of information management technology applications considered:

Technology impacts ***information management***

- Media center networking
- Building-wide computer networking for electronic mail and other applications
- Administration/guidance computer applications
- Teacher management of student records
- Computer laboratory design
- Vocational/technical computer applications
- Science laboratory design

"NO RECOMMENDATIONS" MAY BE GOOD NEWS

A clear result of the Dr. Phillips planning activity with industry was that not every site visit would produce "state-of-the-art" program and design applications. It was as important to *know what not to do* as it was to produce a new technology design application.

Technology is not everything

For some school districts, it would be appropriate to conclude after industry visits that their existing instructional program is the most suitable in terms of learning environment, support technology, and instructional curriculum. No change may be required.

Change for change's sake is not the goal!

Do not force applications that occur naturally in the industrial setting into the educational learning environment. Such a practice could be *costly and ultimately detrimental to instruction and facility planning*.

Evaluating new instructional technology and determining appropriate building application is the strategic role of today's educational facility planner.

REPORT AND RECOMMENDATIONS

The final "Report and Recommendations" that the facility planner prepared for the Orange County Public Schools included 28 recommendations affecting 18 of 24 instructional programs.

Only six recommendations had small associated costs, which were not expected to be a budget factor in a project of this magnitude.* In the end, all 28 recommendations could be accomplished within the construction budget.**

The traditional construction systems required in a typical school building (such as roof, walls, windows, and floors) comprised the vast majority of the school construction budget. *Planning for new instructional technology demands the creative and appropriate design of these standard construction systems to enhance a new philosophy of learning and a redefined learning environment.*

This generally will not require the enlargement of the school building itself. Rather, it demands *redefining functional relationships and construction systems* in order to create tomorrow's learning environment.

FACILITY PLANNER INVOLVEMENT

Dr. Phillips High School is one of the few high school facilities to be planned and designed with a full-time educational facility planner serving throughout the project in a senior management role with the architectural firm.

Educational facility planning is growing in complexity. *Today's educational facility planner is becoming a curriculum leader and an expert in the technological changes impacting learning.*

School districts can find trained professionals who are educators with classroom experience, significant training in curriculum, and practical understanding of new instructional technologies, and who have training and/or practical experience in facility planning, architecture, and engineering. *It is very important, if not essential, that your planning professional have such multi-disciplinary experience.*

The role of the educational facility planner is discussed further in Chapter VII.

* The total construction budget was $24,750,000, including a fully lighted stadium for 6,000 spectators. The budget did not include land and equipment.

** The successful low bid and contract award was $24,450,000, which was $300,000 under budget.

CHAPTER VI

FACILITY MASTER PLANNING: A Businesslike Approach to Educational Specifications

FACILITY MASTER PLANNING:

A Businesslike Approach to Educational Specifications

Continuing advancement in instructional technology has given vast new importance to educational specifications -- the programmatic, functional, spatial, and environmental requirements that school districts list for project architects, engineers, and other building and design professionals before they begin work.

Well-developed ed specs are an investment in the future

If today's and tomorrow's school buildings are to be viable educational environments while effective new methods of instruction join the traditional blackboard, chalk, and slide projector, then school leaders must think through and write educational specifications that are more comprehensive than ever before.

Properly prepared, educational specifications will make our schools an *investment in the future*.

This Chapter will:

- Define the purpose of educational specifications
- Summarize the historical role of educational specifications
- Establish minimum standards for educational specifications

PURPOSE OF EDUCATIONAL SPECIFICATIONS

The purpose of educational specifications is to:

> Define the programatic, functional, spatial, and environmental requirements of the educational facility, whether new or remodeled, in written and graphic form for review, clarification, and agreement as to scope of work and design requirements by the architect, engineer, and other professionals working on the building design.

Ed specs begin with understanding the program

Educational specifications must begin with a thorough, in-depth explanation of curriculum goals and instructional activities that occur within the learning environment.

A detailed description of the educational program enables complete and accurate descriptions of functional and spatial needs and -- in the end -- successful design.

AN HISTORICAL PERSPECTIVE

Historically, educational specifications have taken a variety of forms and demonstrated different degrees of completeness in their role as a pre-design document.

In some instances, educational specifications have taken the shape of a *single-page document* summarizing the square footage, intended enrollment, and affordable budget--without providing an outline of educational programs, a listing of administrative functions, and even "minimum" space standards for the size of the educational areas.

In other instances, educational specifications have been compiled in a *lengthy philosophical document* that belabors learning objectives but never thoroughly addresses the day-to-day operations and functional needs of the learning environment.

Superficial involvement of staff leads to distrust

On some occasions, the development of educational specifications has been an *"exercise"* in involving staff and administrators in the planning process. Unfortunately, there may have been little earnest intent of using this information in the final school design. *Superficial involvement of staff ultimately leads to a lessening of trust and morale in the district.* This is especially true if the final building design does not meet educational needs.

Educational specifications are often:

- Too philosophical
- Too brief ... or too lengthy
- Too "educational," and not adequately specific to architecture and engineering
- Vague as to project scope and budget
- Short-sighted as to the needs of the entire building, site, and community

Schools are an investment!

Seldom have educational specifications been considered an important capital resource management tool that treats land and buildings as an *investment in monetary terms* and an important educational document in *physical terms*.

This assessment of existing educational specifications documents is by no means universal, but it is probably more accurate than many school districts admit.

The historical role of educational specifications is rapidly changing. The leaders of today's and tomorrow's effective schools are learning to write more comprehensive, useful educational specifications.

MINIMUM STANDARDS FOR EDUCATIONAL SPECIFICATIONS

The following elements are standard in the most successful educational specifications documents:

- **Philosophy Statement** A philosophy statement covers the building as a whole and *each* instructional program.
- **Program Goals** The educational goals of each instructional program are clearly defined. This includes learning objectives and the psychological and emotional concerns of students, when appropriate (as in the guidance suite and exceptional education rooms).
- **Program Activities** Well-defined program activities determine functional need and ultimately the design of a successful learning environment.

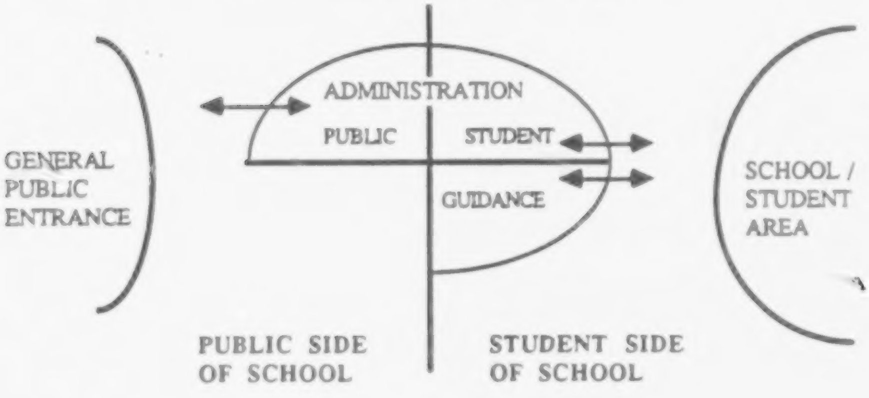
Form follows function!

Remember the saying, *"form follows function."* Program activities, whether in the classroom, media center, or administrative area, determine the "function" of the learning environment.

- **Student Population** The projected enrollment of the entire building and the maximum capacity needed for each space are important in defining spatial requirements.
- **Space Summary** Itemizing each functional space and determining square footage allocations is essential in determining total building square footage and establishing a realistic construction budget.
- **Instructional Technology** New applications of instructional technology planned for the near future and considered for the distant future should be described program by program and in terms of building-wide plans.
- **Functional Relationships** Each program space should be described in terms of its functional relationship to other activities. Functional relationships should also be established between departments, such as math and science, English and the media center, and administration and guidance--as shown in the following diagrams.

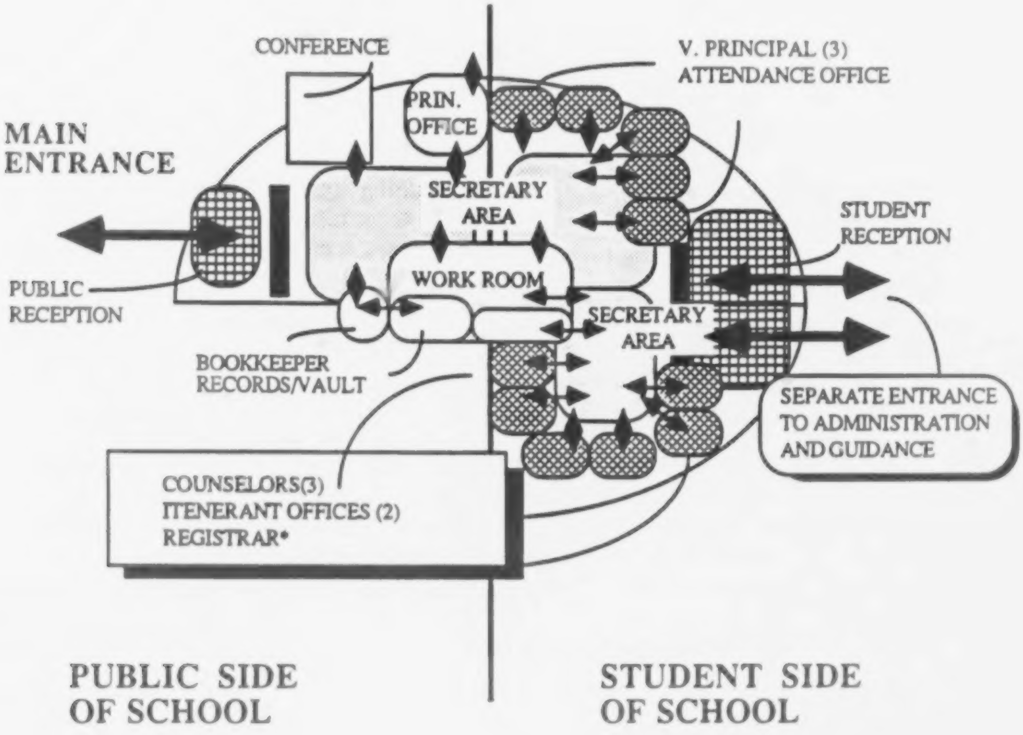
ADMINISTRATION/GUIDANCE OFFICES

GENERAL FUNCTIONAL OVERVIEW



ADMINISTRATION /GUIDANCE

GENERAL FUNCTIONAL OVERVIEW


CONFERENCE
V. PRINCIPAL (3)
ATTENDANCE OFFICE
PRIN. OFFICE
MAIN ENTRANCE
SECRETARY AREA
STUDENT RECEPTION
WORK ROOM
PUBLIC RECEPTION
SECRETARY AREA
BOOKKEEPER
RECORDS/VAULT
SEPARATE ENTRANCE TO ADMINISTRATION AND GUIDANCE
COUNSELORS(3)
ITENERANT OFFICES (2)
REGISTRAR*
PUBLIC SIDE OF SCHOOL
STUDENT SIDE OF SCHOOL

General Conditions In addition to the general program requirements identified above, many educational specifications describe internal building requirements in detail, including but not limited to:

- Heating and air conditioning
- Windows
- Floor coverings
- Water
- Lighting
- Acoustics
- Access for people and vehicles
- Security

One might assume that lighting, for example, is a rather standard provision in a classroom. However, new instructional technology demands new attention to lighting systems. For example, indirect lighting in computer laboratories can reduce screen glare, reduce eye strain, and improve learner success.

Descriptions of *electrical service* should address small-group instructional needs that may be supplemented by multi-media learning equipment (e.g. videocassette recorders and videodisc players). Science laboratories equipped with networked computers require detailed descriptions of electrical needs.

EDUCATIONAL SPECIFICATIONS AS A MASTER PLAN

Educational specifications documents can also serve as master planning documents for school districts' long-term *development and investment* in the learning environment if they also cover:

Good ed specs are a management tool

- Existing-building condition analysis
- Existing-building functional analysis
- Detailed descriptions of new instructional technology
- Community use and accessibility
- Site feasibility studies
- Energy consumption guidelines
- Security plans
- Detailed budget analysis

Each of these elements is described below.

Existing-building Condition Analysis

An existing building condition analysis provides a detailed survey of the building in systems terms, including but not limited to:

- Roofing quality and type
- Mechanical system
- Energy consumption
- Structural systems
- Site condition analysis (slope and drainage)
- Adequacy of parking, circulation, and play areas

A thorough investigation of existing building conditions may lead to questions about the *realistic long-term useful life* of an existing building and its *suitability for renovation and remodeling for continued educational activities*. This is particularly true when considered in light of the introduction of new instructional technology.

Existing-building Functional Analysis

An existing building may be well built, economical, and worthy of remodeling and continued use, *but may not successfully address the functional requirements of tomorrow's education*. A functional analysis compares existing spaces and their functional relationships to the square footage requirements of the program *and* the functional inter-relationships necessary to support the learning process.

A thorough functional analysis may:

- Recommend that the building be converted to an alternative *non-educational use*
- *Identify limitations* to consider if remodeling for educational use is undertaken
- *Identify opportunities for conversion and remodeling* to maximize use of the existing structure for alternative educational programs

For existing building functional analysis to be successful, it should be conducted after the educational program has been well defined and the functional relationships between programs have been clearly established.

Detailed Descriptions of New Instructional Technology

A description of new instructional technology provides a detailed statement of the learning outcome to be met through the use of the technology and a description of each piece of equipment.

Master plan for technology

As new technology shifts education from "teaching" to learning management, the function of equipment and its relationship to the environment is changing. A *functional-use statement* must be part of educational specifications.

Consider the following questions:

- What is the technology application?
- What are the learning outcomes?
- How many people will use the equipment and when?
- Is there a brochure, picture, or catalogue-cut available which will better explain size, safety issues, and electrical service needs.

It may be unrealistic to expect that your design professional can stay abreast of all new educational technologies, equipment, and storage requirements. The influx of new instructional technologies into the learning environment is demanding that more attention be paid during the pre-planning of educational specifications to the functions within the classroom.

By asking teachers and other educators about the internal functional requirements of the classroom, the design team can become more aware of the dimensions (length and width) of space most suitable to learning.

Functional relationships which coordinate instructional television with the placement of the computer networking system can be accomplished. *Such integrated planning can maximize security, consolidate electrical service, reduce screen glare, and minimize design misunderstanding.*

Detailed internal spatial arrangements should be prepared by an educational planner.

Recommending this level of functional detail as part of the educational specifications is not intended to suggest that the educational professional should become a facility planner and designer. When the educator "plays architect" he or she may lock in perceptions of space utilization which are uneconomical, short-sighted, and reflect only one person's subjective feelings

Remember, a school must be designed for long-term use by many personalities, many learning styles, and new instructional technology. It should not become a "one-teacher building."

Community Use and Accessibility

Community use and accessibility must be considered from the start of a design project. The educational speicifications should detail these functional requirements.

Arrangements for community use and accessibility should include but not be limited to:

- Safe and secure evening accessibility
- Well-lighted parking
- Evening security
- Community image and design profile

Site Feasibility Studies

A school site may be purchased or acquired through donation before architectural design. Unfortunately, this can result in the placement of a school on a site not conducive to long-term educational use.

Plan real estate like an investment

Site development standards should be established in the educational specifications and used as selection criteria for purchasing or accepting donated sites. Many businesses, for example, have well-established site criteria for location that identify in detail site size, access requirements, distance to the target demographic population, and other factors.

Educational specifications should include site development standards including:

- Site size for proposed population
- Site circulation requirements
- Site drainage requirements
- Site expansion requirements
- Accessibility for community use on weekends
- Travel distances for students from home to school

Energy Consumption Guidelines

District-wide energy management is an increasingly important part of most school districts' capital resource management programs.

Determining minimum consumption standards is a first step in comprehensively addressing energy conservation. In addition, the educational specifications should address, where appropriate, district-wide goals for:

Energy will increase in price so, CONSERVE

- Passive solar energy opportunities
- Passive natural lighting of educational spaces
- Landscaping plans which include plants and trees that complement passive solar energy design
- Options for energy management systems
- Life-cycle systems analysis that considers energy consumption over the expected system life (This most commonly addresses heating and air conditioning systems, but may also address lighting, windows, and roofing.)

Although energy costs have fallen from the highs created by the oil shortages of the '70s, an uncertain future requires that we continue planning energy conservation into our new construction and remodeling programs.

Security Plans

Educational specifications must address building-wide concerns for security. This is particularly important in light of extended building use by the community and the *value of electronic equipment included in the instructional program.*

The security plan should address building-wide considerations, restricted community use, interior and exterior surveillance systems, and exterior security lighting.

The site plan itself should allow easy night-time patrol by police officers around the *entire* circumference of the building.

Detailed Budget Analysis

Complete educational specifications should include a description of the total scope-of-work, the anticipated cost per square foot, and a description of the building type that can be realistically designed within that square footage construction budget.

Only with a comprehensive educational specifications document in hand can an architectural firm understand its design responsiblities and a school district realistically expect a satisfactory final project.

School districts should conduct budget planning in cooperation with an outside planning professional, construction management firm, program management firm, or architectural firm that has cost estimating capabilities. *This professional service should be contracted separately and with a different firm from the one conducting building design.*

REMODELING AND RENOVATION

Are educational specifications necessary for a major remodeling and renovation project?

Absolutely yes! Today more than ever before!

Ed specs for remodeling?

YES!

Many school districts, particularly in the Midwest and Northeast, are remodeling and renovating existing school buildings district-wide, since student enrollment declines of the '70s made it unnecessary to undertake major new construction.

With today's influx of *new instructional technology,* upgrading the educational environment has become a necessity and even a political issue in many aggressive communities. Educational specifications play a very important master planning role under these conditions.

As indicated earlier, educational specifications for a major renovation and remodeling project must accurately evaluate:

- Existing conditions
- Functional constraints due to previous building design
- Core facilities such as the media center, administrative areas, and food service operations
- Optimum student enrollment based on existing building conditions and site development opportunities
- New instructional opportunities and their applications in the existing building shell

Proper planning for new instructional technology is critical when remodeling an existing building. Existing spaces must be creatively evaluated. *District leaders should open-mindedly consider total conversion of spaces to alternative uses.*

FACILITY PLANNING PERSONNEL

Facility planning personnel today are getting cross-training in curriculum, instructional technology, architecture, engineering, and facility project management. Similarly, curriculum representatives to the planning process are learning more about instructional technology that applies to their subject areas. Together, they can plan how technology can help educators meet curriculum goals.

Facility planners must be able to give clear management and design direction to an increasingly sophisticated cadre of design professionals, particularly in the areas of engineering, information systems design, and energy management. *They must also provide curriculum leadership for technology in many cases.*

Unfortunately, many districts are too small to employ facilities management personnel on staff. As an alternative, program management consulting firms are growing in popularity. This approach can save a district from frequent hiring and firing, since many construction programs last only three to five years.

If your district decides to hire a program management firm, *ensure that a qualified educational facility planner is included on the firm's team or can be hired independently.* As discussed earlier, this person should be experienced in educational curriculum, new instructional technology, and the facility management process.

If an architectural firm is selected to fulfill the program management responsibility, likewise ensure that it has capable educational staff with appropriate continuing education course work in educational facilities planning and curriculum.

STAFF INVOLVEMENT *THROUGHOUT* DESIGN

Staff involvement should not cease with the completion of educational specifications.

Involve staff ***throughout*** *design*

Rather, the preparation of educational specifications should be just the first step of staff involvement in the planning and design process.

With a well-developed educational specifications document as a guide, district staff and administration and community representatives can be meaningfully involved in the architectural design review. *This involvement should occur at each of the three phases of the design process.*

Phase I

Phase I of design review may cover:

Site Plan The site plan drawing may show acreage, contours, dimensions, adjacent transportation routes, parking, service, delivery areas, and existing and proposed buildings.

Exploratory soil test borings to assess site construction suitability may be provided with the site plan.

Floor Plan The floor plan may show overall building dimensions, the size of each space, a legend that presents the net and gross square feet for the individual buildings and total campus, occupant capacity for each space, community use requirements, and potential future expansion.

Cost Estimate A cost estimate should be provided with *each* phase of design. This puts the design team on record with regard to project size, cost per foot, and total construction cost.

Phase II

Phase II of design review may cover:

Site Plan The site plan may include the items identified above under Phase I *plus* a description of physical features which may adversely affect or enhance the safety, health, welfare, and visual environment of students, staff, or community.

Where soil borings have indicated a construction-related condition, solutions and their potential costs may be presented to the school board.

Building Plans Overall floor plans may be presented at a 1/16 -inch scale with student-occupied spaces enlarged to 1/4 inch. Displays of student-occupied spaces should include dimensions and equipment / furniture layouts. This step helps educators visualize the educational usefulness of the space, and helps define electrical service requirements, security issues, and potential student management problems.

An "outline specification" can be helpful at this point in design. An outline specification begins to define *proposed* HVAC (heating, ventilation, and air conditioning) systems, lighting systems, and other elements of construction. This will increase awareness of potential costs and begin to match mechanical, electrical, and roofing systems that are most familiar to district maintenance and facilities personnel. This step can be very important in planning for new instructional technology.

Phase II documents may indicate sewage disposal and water supply systems. They may also provide a *life-cycle cost analysis* of building components that evaluates a construction system's "first cost" (at time of purchase) against the *life-time operation cost -- including maintenance and energy consumption.*

Phase III

Phase III includes complete contractual documents with detailed drawings and specifications. These include a detailed site plan, architectural plans, engineering (civil, electrical, mechanical, and structural) plans, and perhaps special considerations such as acoustical design of music areas.

Frequently, school districts will have the final documents reviewed by a third party for completeness. This reviewer could be a program management firm or another architectural/engineering consultant. This "third set of eyes" can save time and money later in the project.

Once chosen, the school district's plan review team should be used throughout the plan review process. Adding new team members in the middle of the process can upset established goals, objectives, priorities, prearranged relationships, and individuals' functions, and can cause delays in project design. *Whenever possible, keep the same planning and review team throughout the design and construction process.*

In summary, the educational specification document is what the design community has always referred to as a pre-design program. It outlines the scope of work, functional requirements, and other issues necessary to define building requirements before design begins. It is an important tool to communicate district needs to the architect, engineer, and other design team members.

Function, scope, and budget will be determined "one way or the other" -- either early in the project or possibly too late for change. The earlier you understand scope and budget, the better. Changes can be made in an informed manner, at a time when something can be done about them in a logical business-like manner.

Treat the educational specifications process seriously. Understand the process. It is important to your project.

CHAPTER VII

PROGRAM MANAGEMENT: HIRING HELP

PROGRAM MANAGEMENT: HIRING HELP

All too often, school districts get *behind the power curve* in the planning and construction of schools. Classrooms may be seriously overcrowded or so physically deteriorated that community dissatisfaction demands immediate action.

Should this situation be managed improperly, community confidence and educational quality can be hampered for years to come.

A TYPICAL APPROACH

Educational staff often performs only a minimum level of educational needs assessment, and this scanty research becomes the basis for the passing of a bond referendum.

Planning frequently begins after the construction program is well underway

Because of the pressing demand for occupancy, projects may already be under architectural design when the school district hires facility staff. The new facility staff may identify additional needs during design and final construction, pushing budgets beyond referendum capacity.

When construction is complete, significant educational needs may still remain unmet.

Although the above description may be exaggerated, it does reflect the capital construction process for many school districts. The problems of such an approach are many:

- The bond referendum amount may *not* accurately reflect the financial requirements of the instructional program.
- Quality personnel who are building careers may not wish to change positions for three- to five-year construction programs.

- Architects may already have been hired and begun design *before* the instructional program has been completely defined
- *Major building maintenance and life safety* issues may not have been assessed, and may have now become unaffordable
- *Long-term durability and life cycle cost may be overlooked*
- Systems selection (e.g. mechanical, structural, roofing) may be inconsistent between buildings, causing future maintenance problems and potentially large maintenance warehousing inventories

A major construction program is not the time for on-the-job training

All the above issues could require hiring many in-house staff members from a variety of professional disciplines while the facility department's organizational structure is still weakly defined. A major construction program is not a time for on-the-job training in facilities management. Contracting a facilities program management team can be an effective alternative.

FACILITIES PROGRAM MANAGEMENT

Facilities program management is a comprehensive method of managing all capital resource needs, including planning, design, and construction. Program management provides a *single-source professional agent representing the school board*, like an in-house facilities department. Program management may be provided by a construction company, architect, or engineering firm. It is most successful when provided by a company which specializes in this service.

What is Program Management?

Facilities program management can include any or all of the following professional services. The more the better!

- Comprehensive district-wide facility needs assessment
- Existing building condition analysis
- Demographic analysis and long-term master planning
- Budget confirmation for referendum determination
- Educational specifications preparation
- Scheduling of architectural and engineering services

* Plan review/value engineering to maximize dollars spent against design solution and construction quality

* Bid analysis and award

* Construction supervision and/or construction management

* Post-occupancy evaluation (to improve the next project!)

What are these services and how do they work?

Facilities program management falls into three general categories:

I. Pre-planning

II. Design Scheduling and Plan Review

III. Construction Administration

I. Pre-planning Services

The pre-planning role of the facility program manager is to ensure that adequate attention is given to assessing facility needs before the bond referendum is presented to the public. Proper pre-planning can create a high-level of voter confidence.

The involvement of a qualified educational facility planner *experienced in all curriculum areas* is important to successful pre-planning. This person should be well-versed in the most effective methods of involving staff, administration, and community in the planning process.

Many people believe that an informed public, with well-defined educational needs, will work long and hard for their educational system. On the other hand, a community that does not get what it was promised can slow educational progress for ensuing years.

After the bond issue is passed, complete educational specifications are essential to pre-planning each school project. The educational specifications define the educational, architectural, functional, and space requirements for building design and engineering.

Educational planning of each building is the key! Just as pre-planning for the bond referendum defined the "general" district concerns, educational specifications identify each building's facility needs and provide the design professional with a management plan.

In short, a school district must know its needs and present them accurately and fully to the public.

II. Design Scheduling and Plan Review

Many large design or program management firms employ full-time educational planners, architects, and engineers in all disciplines (e.g., mechanical, electrical, structural, and civil). Such firms can design schools themselves or, as program managers, schedule construction programs and review design documents from locally contracted design professionals.

It is helpful if the program management firm has all professional disciplines in-house in order to properly evaluate and make recommendations regarding curriculum goals, design, value engineering,* and cost control.

Such a firm can also conduct "constructibility checks," examining proposed construction methods, recommending changing or simplifying construction methods, and possibly minimizing change orders in the field.

Client involvement must begin with educational specifications

As the school board's agent, the program management firm should strive to be sure that appropriate school district personnel are effectively and efficiently involved in the plan review process. *Client involvement must begin with the educational specifications and continue throughout design and construction*. Facilitating this involvement becomes a primary role of the program manager.

---

* Value engineering is the maximization of dollar expenditure and construction efficiency through the systematic analysis of design documents with regard to educational program, building size, system selection (e.g. roofing, structural, finishes, walls, site development), and many other elements of the proposed building) The State of Washington is a national leader in the value engineering of all educational and state construction projects before bidding.

III. Construction: Bid, Award, and Administration

The construction process begins with the bidding and award of the construction contract. In order to maximize the likelihood of attaining economical construction prices, the program management firm evaluates the area-wide construction climate prior to advertising and awarding bids, and then staggers advertisements for projects. If too many projects are bid at the same time, the availability of qualified contractors may be limited, reducing competition and *pushing up prices*.

After bids are received, the program manager or architect reviews them for completeness and accuracy, and may evaluate bidders' previous performances.

Construction Begins

The construction process can be managed two ways. One is through a general contractor who is solely responsible for the entire construction activity -- including the construction schedule, compliance with construction documents, and legal recourse for the school board in event of non-compliance. *Sub-contractors are selected by the general contractor and are exclusively responsible to the general contractor.*

A second method is construction management. The construction manager acts as the "agent" of the school board and assumes the role of the general contractor in scheduling and monitoring each individual "prime" contractor (sub-contractors under the general contractor arrangement). *The prime contractors contract directly with the school board for each construction element of the building (e.g., site clearing, foundations, concrete, structural steel, roofing, walls, finishes, etc.) although they are being managed by the construction manager.*

Through construction management, tasks such as site work, foundations, structural systems, and roofing packages may have several bidders from which the school district selects the most qualified low bidder. Competition is between "primes," lower construction component bids, and total project cost.

While projects are being built, program management responsibilities include monitoring project schedules, reviewing requests for payment or change orders, and updating the school board on progress and anticipated occupancy dates. The program manager may monitor cash flow to maximize the district's cash reserve.

As project completion nears, the program manager will assist each design architect in determining substantial completion which will allow occupancy, list items that must be finished before final payment is made, and get final building acceptance from the school board when all is finished.

Selecting a Program Management Firm

Selecting the right program management firm can be a tough challenge. The more comprehensive the firm's expertise, the better. The school board should check to see whether the firm has:

- Educational facility planners who are experienced in all curriculum areas and technology
- Full-time architects
- Full-time engineers (mechanical, electrical, structural)
- Full-time Uniform Building Code inspectors

- Licensed contractors
- Cost estimators

Most of all, does the firm have experience in educational facilities? Schools are special!

Program management is a professional service. A successful program management firm needs numerous professional disciplines in-house since many different professional services may be required at different times in the planning, design, and construction process.

Through successful program management, the commitment to quality education can be maintained without the short-term responsibilities of staff employment. The district does not have to "pink slip" staff when construction is complete.

Program management has become a successful addition to the professional services offered to many school districts whether provided by a local architect, building contractor, or program management firm with the above professional services.

CONSTRUCTION PROGRAM MANAGEMENT VS. HIRING IN-HOUSE STAFF

Many issues are involved in deciding whether to hire staff or contract out for construction management expertise:

1. What would be the total staff requirement for the district to successfully conduct all management requirements?
2. Is such qualified staff available in the region?
3. Are district salaries adequate to attract qualified personnel?
4. Will any employed staff be conversant in educational curriculum, instructional technology, and the disciplines of architecture, engineering, and construction?
5. Will a short-term construction program (three to five years) attract suitable career-minded management professionals?
6. Could long-term duties, such as energy management and safety ensurance, be additional staff responsibilities that would make hiring in-house staff cost-efficient?

If the above questions can be answered favorably, then in-house employment of facilities personnel may be appropriate for the construction program. Otherwise, the school district needs to evaluate the experience, educational awareness, curriculum expertise, and instructional technology training of available program management firms.

CHAPTER VIII

MISCELLANEOUS TOPICS OF CONCERN TO BOARD MEMBERS

MISCELLANEOUS TOPICS OF CONCERN TO BOARD MEMBERS

Up to this point, this book has primarily addressed the effect of new instructional technology on educational facility planning and design. The survey of school board members prior to the preparation of this publication (see Chapter II and Appendix I) encouraged that it cover additional aspects of educational facility management. This chapter will highlight and address those concerns, maintaining a perspective relevant to a school board member, policy maker, or senior administrator.

The following topics will be reviewed in this chapter:

- State's responsibility
- Cost control
- Selecting a design professional
- Re-using an existing school
- Passing a bond referendum
- Change orders to construction

It is not the intent of this chapter to make school board members or senior administrators experts in facility management. Rather, this chapter provides an overview of general conditions and accepted practices used to address problems in these areas.

Ask good questions

Decision makers who read this chapter will be able to ask appropriate questions and make more informed analyses of facts prior to their final facility-related decisions.

STATES' RESPONSIBILITY

However much local citizens should control the schools that serve them, education remains largely the responsibility of state governments. State involvement is increasingly important as new tools are applied to the learning process.

State involvement is increasingly important

The purchase and use of technology in the classroom can be risky. Selecting the right instructional programs, computers, and networking systems can be costly and the improvement of educational outcomes questionable. Distance learning, for example, with its equipment demands and operational costs for staffing may be seen as untested and become a low priority when weighed against other educational needs. School districts are cautious and conservative by nature, a trait that may delay technology use.

If technology use is delayed, properly planning the learning environment to complement technology may be particularly difficult to justify in many small, rural, or moderate tax base districts. Yet, an ill-planned educational facility may *preclude* for many years to come the most minimal applications of technology.

School districts that believe in technology may be able to afford only one of several effective technology applications. No matter what the outcome, the final product may be deemed "successful" out of political necessity or because an alternative plan is not available for evaluation. In truth, the technology and/or the design solution may not really work.

State leadership for both technology and facility planning can provide many benefits:

- A variety of applications can be tested and evaluated objectively at the state level.
- Successful solutions can be refined, documented, and made available to other districts in the state.
- Meaningful communication is far more likely between the 50 states than the 15,000 school districts throughout the country.
- State-wide evaluation and funding is more likely to result in equal educational opportunity among school districts within the state and ultimately throughout the nation.

Equal educational opportunity may be in question!

Equal educational opportunity may come into question as new instructional technology enters the learning environment. Inadequate educational facilities may be an important element to the equity question as poorly designed buildings preclude the cost effective use of technology when it becomes more affordable.

Those districts unable to afford flexibly planned construction programs now may be hampered educationally for many years to come while affluent and strategically planned districts may gain education benefits far beyond their initial planning and capital costs.

State governments must get on the technology bandwagon and support school districts in evaluating technology and providing a learning environment which will enhance its use. States like Florida, North Carolina, Washington, and California are already notable leaders. Other states have a long way to go.

COST CONTROL

School boards, and ultimately school board members, are all too often confronted with construction projects that run over budget. This can be extremely disheartening, since total funds are always limited and such an event can disrupt the flow of money to other projects. At worst, it can undermine district credibility and community support for the entire school system.

Although cost control responsibility does not traditionally rest with school board members, school boards can apply several accepted practices to help manage and maintain project budgets. The key factors are:

- Accurate scope-of-work definition
- Capable educational facility planner
- Well-defined professional services contracts
- Phased cost estimating
- Value engineering
- Constructibility plan review
- Change orders avoidance and management

Accurate Scope-of-Work Definition

Very frequently, project budgets are exceeded during construction because the project budget was not accurately determined in the first place. This is commonly the result of a poorly defined scope-of-work.

The scope-of-work defines explicitly what is to be accomplished by construction

The scope-of-work defines in explicit detail what is to be accomplished by the construction program, covering new construction, remodeling, and renovation. The scope-of-work should include total square footage and extent of anticipated remodeling or renovation.

With a well-defined scope-of-work, in-house personnel or an outside contractor can analyze anticipated construction costs. To this total will be added architectural fees, legal fees, bond financing fees, site acquisition costs, professional services fees, and equipment costs for a total project budget.

A pre-designed master plan or the development of educational specifications are important to preparing a complete and accurate scope-of-work. Either of these two documents should define the total project in detail and provide itemized cost projections for each component of the project, including actual and hidden costs.

All cost data should be reviewed and concurred with by the selected design professional and included in the design contract *prior* to commencing design.

Capable Educational Facility Planner

Educational facility planning is an expanding profession which can provide invaluable assistance to a capital construction program. The educational facility planner provides the liaison between educational needs and design services. Typically, this individual is cross-trained in education, architectural services, and construction.

The educational planner must understand program and technology

Involving an educational facility planner in the construction program highlights the importance of *education and learning objectives in defining the goals of the educational environment*. The educational facility planner can be particularly helpful in designing for new instructional technology.

Facilities personnel must be able to *communicate effectively with curriculum representatives* who are pushing for the most effective instructional tools. They must also be able to give clear direction to an increasingly sophisticated cadre of design professionals, particularly those in engineering, information systems design, and energy management.

School districts that hire program management firms rather than in-house facility planning staff should give special consideration to firms that employ competent educational facility planning personnel experienced in educational curriculum, educational technology, and facility management.

Well-defined Professional Services Contracts

In a facilities construction program, the contract for professional services is usually made with the architect, but may also include engineering, bond financing, real estate, and other services.

All contracts should be reviewed and approved by a legal professional representing the school board prior to award. This legal representative should be familiar with professional services practices and general practices in the construction industry.

Time and money spent in contract review prior to final board approval can be extremely worthwhile.

Be sure
the AIA contract is
modified for
the specific project

Frequently, architectural contracts are prepared in accordance with the American Institute of Architects' standard contract for architects. This is a fine and valuable document, but one must remember that it has been prepared by architects for use by architects. School boards that use it should be careful to ensure that its applications are appropriate and *in the best interests of the specific design project and the overall construction goals of the district.*

Objective third-party professionals can help the school district negotiate professional services contracts and make appropriate recommendations for modifying a standard form contract to further protect the school board's interests.

Phased Cost Estimating

Traditionally, for medium to large scale construction projects, architectural documents are submitted in three phases. This significantly assists the design process and plan review by the client, as it breaks the process into well structured pieces (See chapter VI.). *The design architect should submit cost estimates during each phase of design.*

Define cost-estimating
procedures
in advance

Cost estimates may be prepared by the design architect or an outside cost-estimating consultant. The method of cost estimating should be considered and approved in detail by all parties during contract negotiations.

The school board may incur additional fees if its design firm uses an outside cost estimator or contractor. The school board may, of course, request from the design firm copies of billings related to these services and even the actual cost estimate report.

Phased cost estimating aids in monitoring compliance with the project scope-of-work. Project budget increases may reflect inadvertent increases in the project scope-of-work.

By monitoring construction costs throughout design, reevaluation of project scope-of-work can be effectively conducted before bidding and construction.

Project cost control can also be strengthened through the use of value engineering and constructibility plan review.

Value Engineering

Value engineering is an attempt to systematically evaluate the appropriateness of a design solution to its function and cost. Any design decision should be evaluated to ensure that its cost accurately equates with its economic benefit.

Value engineering gives the biggest "bang for the buck"

Just as it may be "overkill" to swat a fly with a sledge hammer, it may be equally unwise to put a brick exterior on a storage shed or an expensive wood laminate structural system on a small pre-school addition. (Although circumstances could make these decisions appropriate.)

Value engineering provides an objective and systematic means of evaluating these cost factors in relation to the entire project scope and budget.

Life-cycle costing makes your building a well -planned investment

Value engineering, when conducted properly, is far more complex than the above example. It may include detailed analysis of building scheduling, solar orientation, and people-load of each area of the building -- such as the auditorium, media center, and classroom units. It extends to analysis and design of the entire building's mechanical systems based on maximum life-cycle cost. (Life-cycle cost takes into consideration all the client's costs for a design solution, including installation, maintenance, and operational requirements, such as electrical consumption.)

Constructibility Plan Review

Although a number of buildings may appear the same to an untrained eye, there may be many construction system solutions that can accomplish the same environmental design and physical appearance. Various design solutions may have substantially different construction cost implications.

A complex design can be expensive

Simplicity can save money

A constructibility check (usually conducted during Phase II and Phase III design; see Chapter VI) evaluates each design solution in detail. This may include analysis of structural systems, roofing systems and flashing, exterior brick-to-building interface, and foundation systems.

A well-implemented constructibility check can recommend simplified construction alternatives that maintain the design and the user's intent for the building while lessening construction cost.

A thorough constructibility check reviews and evaluates all disciplines: architecture, engineering, and specialized facility areas such as food service.

The school may be best served when the constructibility plan review is conducted by a properly qualified outside third party. As with all professional services contracts, the scope-of-work and expected results should be well defined and the professional services fee negotiated prior to the commencement of work.

SELECTING A DESIGN PROFESSIONAL

Selecting the right architectural or engineering design professional can challenge the wisdom of any school district. Factors frequently considered in this process include:

- Proximity (local firms pay local taxes)
- Experience in school design
- Design philosophy and style
- Size of firm
- Past success in cost control

Other issues worth considering in selecting a design professional include:

- Project staffing
- Impression made during office visit
- Previous school design experience
- Support engineers

Project Staffing

Firms are awarded contracts, but individuals do the work.

Firms are awarded contracts

Individuals do the work

The school board and selection committee have a right to know the individuals who will work on their project. Who will be the project manager and client contact? Who will be the project designer? Have you met these people? Have you reviewed their work during the interview process, *or the work of others no longer with the organization?*

It is appropriate to write the names of the people on the design and planning team into the professional services contract. Changes in personnel may require review and approval by school board staff. In this fashion, a clear line of communication and responsiblitity can be maintained with your design professional.

Office Visits

How many people have actually visited an architect's or engineer's office? Usually, visits are made only to the construction projects.

Visiting the work place of your prospective design professional can provide tremendous insight into organization, staffing, professionalism, and -- most importantly -- attitude toward design and the building environment.

Visit the architecht's office

If their own work environment is stimulating and sensitive, the firm's attitude toward the design of your facility is likely to reflect those attributes. *If the environment is cluttered, dull,* or *"far-out," be so advised.*

Previous School Design Experience

School experience alone may limit your architect

A frequent criterion for professional services selection is previous experience in school design. This is a very helpful criterion, but ***it should be used with caution.***

Also check whether:

- The people responsible for the educational design projects advertised by the firm *are still with the company*
- *References* indicate client satisfaction
- Completed buildings reflect your school district's *image and philosophy*
- Completed buildings ***successfully*** *implement new instructional technology*

Architectural firms that do not solely design educational projects may deserve serious consideration. Although firms may promote that 90 percent of their design work is in schools, *this may actually reflect a limited design perspective.*

Firms that have diversified experience -- which may include hospitals, hotels, office buildings, and even parks and recreation projects -- can bring a broader and more successful wealth of experience to your school project.

An architectural firm that has successfully designed "smart buildings" (with word processing/data management networking, computerized energy management, or high-tech laboratories) for the private sector may have tremendous insight and experience in providing cost-effective design for your ***"smart school."***

Remember to check that the personnel who will be responsible for your project were responsible for (or had access to individuals responsible for) these "smart buildings."

Engineering Consultants

Historically, school boards place tremendous emphasis on selecting the design architect. Little attention has been paid to evaluating the experience and capabilities of the design engineer.

Know your engineer

*As new instructional technology and "smart schools" become more sophisticated, **the selection of the consulting engineer as** part of the design team requires closer attention.*

All issues related to the selection of the design architect apply to the design engineer, including:

- Visit to offices
- Definition of personnel who will work on your project
- Past change order experience
- Experience in other building types

In many ways, the engineer will have more impact upon planning for new instructional technology than the architect. Be sure you are selecting your entire design team.

The Local Architect

Many school districts exhibit favoritism to the local architect. Some school districts actually mandate that the architect be local. There are some very justifiable reasons for this practice. Local architects pay taxes in the school district, are members of the local business community, and probably have school board personnel as friends and neighbors. Their children go to school in the community, and their spouse may be a teacher.

Unfortunately, a local firm may not have significant recent experience in educational facility planning and design!

Hire the most capable architect, local or not

Since school building design and new instructional technology are becoming very complex, it is increasingly important that the successful design professional be the most capable one to fulfill all the design requirements of your project.

If local preference wins out, consider encouraging the local firm to include an educational facility planner on the design team to bring in-depth experience in educational facilities, instructional technology, and up-to-date planning practices. In this manner, the local firm can serve the school district well and gain exposure to valuable tools for the successful planning and design of your district's next project.

RE-USING AN EXISTING SCHOOL

Circumstances sometimes encourage school districts to re-use the plans of existing buildings within the district or from a neighboring district. Reusing an existing design can reduce design fees and give the design team an opportunity to visit and evaluate the existing building for its appropriateness. However, *the decision to re-use an existing set of design documents should be undertaken with extreme caution and objective evaluation.*

Evaluate the the building for your program needs, not just looks and budget

On occasion, school board members and others visit extremely expensive, recently constructed educational facilities and, in a matter of minutes, conclude these designs are appropriate to their districts' educational needs. In the case of a large middle school or a small high school facility, this could easily be a $15 million decision.

A 15-minute walk through an existing building is ***not adequate*** *to determine educational appropriateness and suitability to your construction program.*

Before deciding to re-use an existing building's plans, a school district must:

1. Prepare educational specifications that reflect its educational goals

2. Conduct a detailed review of the proposed building in light of the district's educational functional requirements

3. Carefully evaluate the media center, science facilities, instructional television, and computer spaces for educational appropriateness

4. Consider whether the building will fit well into the community in terms of *design and aesthetics*

5. Ensure the building will *fit well on the site*

6. *Review change orders* to evaluate flaws in design that may have increased construction costs

7. Conduct a value engineering and constructibility plan review *prior* to final contracting for re-use

This process may save time and money, reduce the number of change orders, and increase the likelihood that the building design proposed for re-use will legitimately meet the educational requirements of your school district. *Selecting an existing facility must not be an emotional and subjective process.*

Be wary of re-using plans which require "only minor changes." A well-designed building is an integrated and complex product. The functional arrangements, construction systems, budget, and site planning are all deeply interrelated activities. Once modifications begin to be made to construction documents, the integrity of the original design and its suitability to the school district may be seriously altered.

The strengths of conducting your own design activity to meet your individual building requirements are many:

- Specific planning and design relate directly to your site
- Your educational requirements are specifically addressed
- Current and future instructional technology can be evaluated and accommodated in your building
- District staff and the community can be involved in the design, enhancing morale
- Academic support areas such as the media center, administration, and auditorium facilities can be properly sized for the intended enrollment

Plan core areas carefully and for the full enrollment

As already mentioned, a school is a balanced functional, structural, and design arrangement. Core areas such as the media center, administrative areas, and cultural spaces should be planned and designed to be in balance with intended student enrollment. For this reason, classrooms should never be added to an existing plan without serious consideration of the impact more students will have on these core areas.

PASSING A BOND REFERENDUM

Successful passage of a construction bond referendum is a complex event. Many marketing firms help school districts evaluate community feelings about passage of higher taxes.

Identifying favorable voters may be part of the professional services offered by such a marketing group. This aspect of bond referendum passage is beyond the scope of this book.

Other factors which are related to facilities management may also be relevant to successful bond referendum elections.

Scope-of-Work

Knowing the scope-of-work builds community confidence and positive voters

A well-defined scope-of-work, with accurately prepared cost estimates, can be essential to gaining community support and confidence for a major construction program. As communities become more sophisticated and demand more cost-effective and progressive leadership from government, clearly defined construction objectives are essential to election success.

A well-prepared capital construction master plan can be instrumental to building this voter confidence. Such a plan can ensure that:

1. *All* schools are evaluated fairly and equitably
2. Each scope-of-work is defined in advance and *accurately estimated*
3. A project schedule is prepared to bring "vision" into reality
4. The school district has an image of business-minded leadership and management

A well-developed master plan can help a school district avoid -- or at least plan for -- many future problems.

All too often, a bond referendum is passed because school overcrowding or building deterioration has reached catastrophic proportions. Parents and taxpayers demand immediate action and political pressure grows.

As a result, a construction program may be hastily prepared addressing additional classrooms or cosmetic renovation. This may be at the expense of comprehensive evaluation of the entire building or school district needs. Frequently, core areas and services such as libraries, instructional television studios, community use areas, computer networking, and new instructional technology may be overlooked, ignored, or given little attention.

The ultimate results of hurried and poorly defined construction bond programs are well documented. The scope-of-work promised to the community may not be affordable. The schedule for implementation may be lengthened in the hope of identifying additional funds. *The need for a second bond referendum may become necessary, while all along the community was "sure" that all educational needs had been addressed "the last time."* As a result, voter confidence may be eroded and future success with the electorate left in doubt.

CHANGE ORDERS

A change order is an alteration to a construction contract after the contract has been approved and amended. Most typically, change orders occur after the project is under construction.

ALL change orders (additive or deductive) cost the district money

Change orders are undesirable to school board members because they *typically require additional payments to the contractor.* Change orders are usually *more expensive* than if included in the original construction contract because they affect schedule, deliveries, and any required demolition of work already completed.

Unfortunately, it is almost impossible to totally avoid change orders in the construction process. However, specific procedures can curtail the number of change orders and properly manage them when they do occur.

Change orders occur for several reasons. The first and most accepted reason for a change order is an unforeseen condition which develops during construction. A common example is poor soil conditions below the construction site, requiring land fill, additional compaction, or other modifications to the originally anticipated construction procedures. This unforeseen condition can result in a change order *both in dollars and in time required for construction.*

A change order can also result from an error or omission of the design team that prepared the bid documents. Remember that architects and engineers are human and may leave out a design element that is essential to the project. Again, such a condition can result in a change order in both dollars and project construction time.

In both of these examples, the quantity and size of change orders can be reduced, although probably not eliminated through proper facilities management.

Minimizing Unforeseen Conditions

Unforeseen site conditions -- such as sub-surface mud or a particularly high water level -- can seriously impact the early stages of construction.

Look for unknown conditions ***before*** *award of bid*

The most common way to avoid this type of change order is to conduct thorough site investigations of subsoil conditions prior to site purchase, not just prior to construction.

The school board should contract directly for soil investigations, establishing a direct line of liability between the board and the site surveyor. These are not services typically allocated to the architect.

Other unforeseen conditions such as hurricanes, tornadoes, and even extensive periods of rain can result in change orders and seriously disrupt the construction process. These conditions are addressed by insurance packages provided by the contractor or through the extension of construction time.

Check with the weather bureau and field reports from staff when a contractor submits a change order asking for a time extension due to weather. Bad weather may be a scapegoat for poor scheduling by the contractor.

Minimizing Errors and Omissions

Every set of design documents is likely to have some error in it. Errors are usually small, do not affect the project bid price, and can be corrected by "field changes" between the architect's representative and the contractor. It is important to note that such "field changes" are only for minor changes.

To avoid major change orders due to errors and omissions, the school board can undertake several accepted facility management procedures and practices. First, during the architect/engineer selection stage, district staff should review with previous references the architect's performance and completeness in the preparation of construction documents.

- How many change orders occurred during previous projects and, more importantly, what were their causes?

- Were change orders substantial in dollar amount and/or time?

Properly evaluate architects/engineers' change order records

It is *not* fair to evaluate an architect's or engineer's previous the performance based on the number of change orders alone. The important issues are *why* the change orders occurred and their value.

Properly managing plan review during the design process can also minimize change orders. This includes plan review by the architectural and design team and possibly plan review by an outside third party -- such as another architectural firm, a construction management firm, or a program management firm -- on behalf of the school district. School districts with significant in-house architectural staff may conduct plan review internally.

Regardless of the method used, thorough plan reviews must be conducted during all three phases of design, most importantly Phase III. (See Chapter VI for a description of the three phases of design.)

Use of computer-aided design (CAD) may reduce design errors due to poor coordination between design professionals. For example, an electrical or mechanical design scheme can conflict with structural engineering. Such a conflict may not be noticed until after construction begins, resulting in a change order. *CAD design systems provide an electronic means of examining each design element and identifying areas of conflict prior to the completion of design.*

Change Order Procedures

The school board should establish and adhere to strict change order procedures that are in the best interest of the school board but remain in compliance with fair and reasonable construction industry practices.

Such procedures include:

1. Requiring clear documentation of the change order to be prepared and submitted for approval, in writing, to the architect prior to submission to the school board
2. Demanding that change orders be submitted by the contractor, through the architect, as soon as they are identified
3. Requiring detailed cost analysis from the architect at the time of the change order request
4. Demanding that time extensions due to weather or other conditions be submitted soon after the resumption of work

Changing Your Mind Equals Change Orders

If the school board decides to change the construction scope-of-work, *it has that right!*

A legitimate change may be needed due to increasing student population and the requirement for additional classrooms, for example (although even this should be avoided). Other changes, however, may be frivolous and reflect individual desires -- as in a decision to use brick versus stucco for the building exterior. *Change orders, regardless of the reason, are traditionally more expensive than the cost would have been if they had been included in the original construction contract.*

Contractors bid construction documents and align themselves with numerous sub-contractors in order to fulfill contract responsibilities and produce a return on investment (profit) for their companies. Change orders that delay progress and management of sub-contractors or require ordering additional equipment, forfeiture of pre-stocked supplies, or demolition of completed work can be extremely costly to the construction process. These costs, plus the inconvenience they cause, are passed on to the client with the change order.

Needless change orders should be avoided at all costs.

Errors and Omissions - The Architect/Engineer

As stated earlier, architects and engineers are human. Errors and omissions can develop in any construction document, even one created by the best and most professional design team. A school board may need to seek reparations for such errors.

Architects and engineers can make mistakes too

Payment by the design professional to the client for errors and omissions is a complex process. School districts should ensure that the architect has proper professional liability insurance prior to awarding the contract. If insurance levels are not adequate and premium costs are high, the school board may consider underwriting costs for the design team.

The architect is financially responsible for increased construction cost above the amount that would have normally been incurred had the omission been included in the original design package.

For example, if electrical service was originally required for the music room but forgotten in the design package, the basic cost remains the responsibility of the client. *Additional* costs resulting from tearing down walls, removing ceiling tiles, and other related issues necessary to add that building feature at a less convenient time in construction is the responsibility of the design architect.

Managing Change Orders and Making Payments

Managing change orders and making payments may have significant legal ramifications. The school board should solicit legal advice whenever necessary to protect and properly fulfill the responsibilities of the district to the taxpayer and/or other parties.

Deductive Change Orders

Deductive change orders seldom save money

A deductive change order calls for funds to be returned to the school board for services *not rendered* during construction. Many school boards may consider this a rebate or a windfall.

The school district's representatives must scrutinize deductive change orders with as much or more attention than additive change orders.

A $5,000 driveway may require deletion from a construction contract. The deductive change order, however, may only be for $3,000.

***Extreme caution** is recommended when reviewing and approving deductive change orders.* Like all change orders, they should be reviewed and approved in writing by your design professional and (if available) in-house staff or your program management team.

CONCLUSION

We must stop merely planning for technology and realize that technology is here! It is changing the face of education and the methods by which we move from a teacher-focused classroom to a *learning focused management system*. This change is not simply a change in program and teacher skills, but includes the total environment in which learning will occur. *We must plan and design our schools to enhance instructional applications of technology.*

Technology is more than computers. *Technology symbolizes a fundamental restructuring of the methods of information transfer at all grades and ages -- adults included.* Thus, our entire attitude toward education must be redesigned into school buildings.

Technology impacts every program area

Technology impacts general classrooms, science laboratories, technical education areas, exceptional education, and business education differently. It impacts all grade levels. Technology impacts art, music, and drama. It is restructuring the media center, administrative office, guidance center, and district-wide information management.

Technology is lasers, robotics, and computer-aided drafting. It is energy management.

Each technology application must be part of a well-defined educational curriculum with quantifiable learning outcomes. *The learning environment must complement educational goals.*

Our private industry is a leader in world technology. Industry can play an important role in planned education and schools. This book illustrates a uniquely planned school that included Walt Disney World, Sea World, NASA, and others in a school design process. The process of involving industry in education is possibly more important than any single design solution developed for this particular facility. *Working with industry opens channels of communication, provides in-service training for teachers and design professionals, and creates community involvement.*

The Dr. Phillips High School example demonstrates the importance of staff and administrative involvement in the planning and design process. *It illustrates that construction is not just a design process, but also a people process.* It displays the importance of cost control within the process.

This book addresses several specific technologies impacting education. Facility implications are presented in general terms for science, elementary education, instructional television, the media center, and others. They provide a *guideline for district self-evaluation* so that future action can be planned and implemented.

School board members are policy makers, not administrators

School board members are policy members, not administrators. Actions should begin with overall strategy, leaving implementation to properly trained professionals. One important first step is the educational specifications.

Educational specifications provide a management tool for scope of work determination, budget determination, functional need assessment, and new instructional technology. When professionally prepared, this document can be extremely valuable in controlling cost, improving the design schedule, and providing more flexible buildings for specific learning technologies.

A school is a complex building with many very different educational goals. Few if any design features can be flexible for all potentialities.

Instead, *each* technology must be identified for *each* instructional program. The learning outcomes and program activities must be well defined. Then, educational function and building design can be accomplished with legitimate flexibility for the future.

This book emphasizes doing the basics well

This book goes beyond technology to address the total facility management process, including facility program management, professional services selection, and cost control. *It emphasizes doing the basics well in addition to planning for the future.*

The future is already here! School districts need only to look around. ***We must plan, of course.*** ***More importantly, we must act.*** Although mistakes may be made, waiting for the perfect answer will delay important "field experience" gained only through actual involvement of staff, students, administrators, community, and the designers of tomorrow's learning environment.

Remember, *the world is changing. Education is changing. And, the future belongs to those who can participate in it!*

APPENDIX I:

PLANNING FOR THE 21ST CENTURY -
Questionnaire used to survey school
board members regarding facility
planning concerns

PLANNING FOR THE 21ST CENTURY
NEW INSTRUCTIONAL TECHNOLOGIES AND EDUCATIONAL FACILITY DESIGN

The following questionnaire addresses educational facility planning generally and the specific impact that new instructional technology will have on educational facility design. The results will be used to assist in writing a book on this subject for the National School Boards Association.

Your assistance in completing this questionnaire is most appreciated.

1. Please rate the following facility planning topics as you see their importance to school board members.

1 Very Important	2 Important	3 Modest Concern	4 Unimportant	5 No Opinion

_____ How to accurately assess facility needs.

_____ How to plan and design for new classroom technologies.

_____ Keeping construction projects within budget.

_____ How to pass a bond referendum.

_____ Managing change-orders effectively.

_____ Getting your money's worth as a school board.

_____ Selecting design professionals (architects, engineers, etc.)

_____ Energy Management.

_____ Establishing instructional area space standards.

_____ Options for managing facility operations (in-house vs. outside contract)

_____ Ensuring your architect understands you.

_____ ________________________________(Write in)

_____ ________________________________(Write in)

Special Comments: ________________________________

____

____

____

____

2. **Would you like this book to specifically identify examples of instructional technology and the impact it has on school design? _____ Yes _____ No**

If yes, please rate the following.

1	2	3	4	5
Very Important	Important	Modest Concern	Unimportant	No Opinion

_____ Preschool

_____ Elementary Grades

_____ Middle School

_____ High School

_____ CCTV

_____ Others __________

_____ Community Education

_____ Science Facilities

_____ Vocational Facilities

_____ Exceptional Education

_____ Media Center Areas

_____ Others __________

3. **Would you like to see design guidelines developed which identify new instructional technology and define specific architectural or engineering requirements?**

_____ Yes _____ No

Should they be part of this book? _____ Yes _____ No

Should there be a more detailed follow-up publication for district-level facilities staff use?

_____ Yes _____ No

Comments:

4. **Technology is only one portion of successful educational facility management. Would you like this same book to briefly overview successful facility planning and management procedures for school districts?**

_____ Yes _____ No

5. On the scale below, please indicate how your school district is addressing new instructional technology in its planning and design of educational facilities.

Very Successful	Successful	Adequate	Needs Improvement	No Strategy at Present
_____	_____	_____	_____	_____

6. Please make any general comments you feel are important to facility planning or new instructional technologies from a board member's perspective.

7. Please provide the names, addresses, and telephone numbers of any staff persons concerned with facility planning for new instructional technologies (or share this questionnaire with them).

Upon completion of this questionnaire, please return to:

Dr. Franklin Hill*
Franklin Hill & Associates
13421 N.E. 47th St.
Bellevue, WA 98005

OPTIONAL: Would you like the results of this survey? _____ yes _____No

Name____
School District ______________________________________
Address ____
Telephone Number ___________________________________

* New address from the time of this survey, originally conducted from Venice, Florida.

APPENDIX II:

"A MASTER PLAN FOR SCIENCE,"
BY FRANKLIN HILL, PH.D.
Published in American School & University,
June 1985

SCIENCE FACILITY MASTER PLANNING,
ORANGE COUNTY PUBLIC SCHOOLS,
ORLANDO, FLORIDA

A Master Plan for Science

With state requirements *and* enrollment going up, Orange County needed to expand lab facilities—and the experimental approach wouldn't do.

by Franklin Hill, Ph.D.

PROMPTED by recent state legislation and a changing community, the Orange County Public Schools in Orlando, Florida is taking a lead in structurally "de-worming" the educational apple.

The Florida Legislature enacted the RAISE Bill (Raise Achievement in Secondary Education) in July 1983 to improve the state's educational system. Among its many aspects, the bill substantially revised the general requirements for high school graduation. This revision heavily impacted the science curriculum with students in ninth through twelfth grades being required to achieve three science credits. Two of those credits must involve lab work.

The change meant that more science classrooms would be needed. However, Orange County chose to avoid the common approach of taking a non-science classroom, adding some sinks and electrical outlets, and calling it a science lab. Their avant-garde method involves taking a realistic look at the future of their schools and their community.

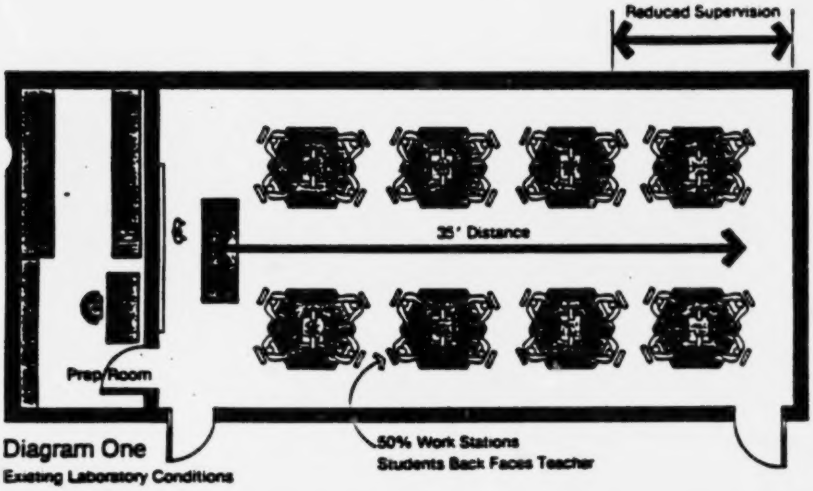


Diagram One
Existing Laboratory Conditions

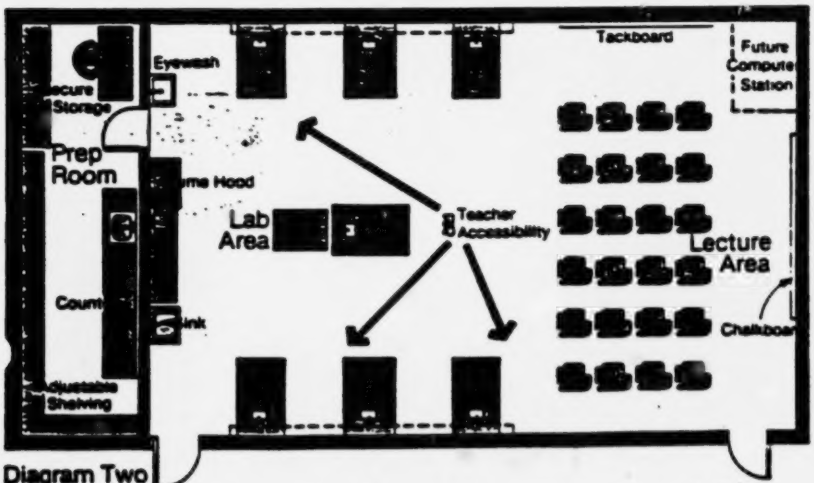


Diagram Two
Chemistry/Biology Prototype Classroom

This school system is giving serious attention to the prominent role technology is taking in the future, especially in Central Florida. In spite of the limited funds available, Orange County intends to provide students with quality science facilities that will prepare them to meet the educational demands of the adult world. Simultaneously, they mean to guarantee that increased quality in the science program will not result in decreased value in other academic areas. Because of the expected increase in pupil population, Orange County needed a plan that would not be obsolete before its implementation.

As a result, the firm of Pierce Dorsey Rohrdanz Architects, Inc. of Winter Park was commissioned to devise a cost-effective *District-wide Science Facility Master Plan* that would not compromise quality.

The first step was to study the school system's 135 existing classrooms. A series of planning sessions with teachers, science department heads, principals and district staff helped pinpoint the trouble areas.

Existing conditions

It was found that Orange County's older facilities no longer met the size and occupancy requirements recommended by the Florida Department of Education. Orange County was also concerned that some of the classrooms' limitations might not enable students to safely conduct more in-depth experiments that could be required in the future.

A leading problem was the instructional difficulties imposed by the classrooms' physical limitations. A foremost obstacle to the teacher was keeping the attention span of teenage students as far away as 35 feet. In some of the classrooms, 50% of the students sat with their backs to the teacher. Unfortunately this provided a more conducive atmosphere for students to daydream about the special effects of *Star Wars* than to concentrate on the scientific principles of Isaac Newton.

Prototypes

Solutions to these problems were reached through the joint efforts of PDR Architects and the staff of the Orange County Schools. Two flexible prototypes evolved: one for chemistry/biology and one for physical/general science programs. The prototypes addressed every structural aspect right down to the storage cabinets.

Flexibility of the prototypes was a foremost goal. They were designed to be easily modified to fit each school's projected growth and existing structure without loss of quality. This assured that schools in all areas of the district would have equal facilities.

As an example, the chemistry/biology prototype shown in the diagram illustrates the adjoining of a lecture and a laboratory area. This eliminates the teaching problems found in the old structure as students and teacher are outside the lab area when lectures are in session. This reduces the likelihood of vandalism or distractions. Also included in the prototype is a location for future computer installations that can be easily modified into a suitable low-noise, non-glare area.

Sunbelt growth

Central Florida is one of the fastest growing areas in the United States. Planning for increasing enrollments is vital to devising a plan that will not be obsolete before completion. In addition, plans are being made to move all ninth graders to the high schools. Although the traditional role of the architect would not have addressed these educational concerns, the planning consultant for PDR Architects proceeded to assist Orange County in planning future classroom requirements.

The following process was used to project overall enrollment in science classes accurately through 1989: (1) Determine overall school enrollment based on projections provided by school board staff; (2) Ascertain the percentage of those students that would be involved in science classes on any given day; (3) Pinpoint maximum class size; (4) Determine the number of class periods per day.

The district used a careful formula to find the number of classrooms needed by 1989.

Studies revealed that 85% of the total number of students would participate in the daily science curriculum. This percentage included 10% of those students who might repeat classes due to previous failures or who required advanced placement opportunities. A maximum of 24 students per class was used in the planning process as defined by state statute. Step 4 was predetermined by the Raise Bill mandating a seven period school day.

Three final phases completed the process. The seven periods per day were multiplied by the class size. This yielded the maximum number of students per classroom for any given day. Ninety-five percent of this figure was used to allow flexibility in scheduling students. The number of students taking science in one day was divided by the maximum load for each classroom. This determined the number of classrooms required by each school.

Through surveys, each existing science classroom was rated as superior, satisfactory or unsatisfactory depending on its ability to meet the quality and size requirements of the instructional program. The number of existing superior and satisfactory classrooms was subtracted from the number of classrooms needed by 1989. The net result was the number of additional spaces to be developed for each school.

Campus plan

At this point, the entire science program was analyzed. Departmental storage requirements, grouping of related classes, and provisions for advanced placement classrooms were incorporated into the study. This plan was then compared with the overall educational program for the school. If it was determined that a particular facility or site might not have enough expansion room to provide a properly balanced curriculum in *all* subjects, a recommendation was made to consider limiting total student enrollment and thus the science program accordingly.

The culmination of these studies produced a Science Department Facility Plan. An individualized version of the plan was developed for each school based on its construction type, history, and site profile. Included was a summary listing the satisfactory classrooms and projected 1985 through 1989 needs. Finally, the plan provided a method for phasing construction over a period of several years. Recommendations for new construction, major remodeling, renovation and cost estimates were included.

Portable labs

When a school is renovated to accommodate a growing number of students or to broaden an educational program, the problems of pupil displacement and overcrowded classrooms are inherent. PDR Architects' final assistance dealt with alleviating these problems.

Portable classrooms can be used for in-service training, as well as science labs.

Several portable classrooms were developed to aid the school system in continuing classes during construction periods that could potentially last several years. The portables were designed to remain useful to the school system long after new classrooms were completed.

Portables may be used as additional science classrooms should student populations grow faster than the rate of new classroom construction. Another potential use is to transfer the portables to junior high school campuses. This would provide a transitional setting for younger students to become familiar with more advanced lab exercises before tackling the tougher high school curriculum. The portables can also be used as training facilities for in-service training of science teachers.

As intended, the overall plan provided a timely method to handle the increasingly important science curriculum, but it assured that those changes will not stifle the remaining academic programs in the process. Thanks to the prudence and planning of the Orange County Public Schools, their academic apple is being polished to a brilliant shine. ○

Hill is director of Educational Facilities Planning for PDR Architects, Inc. (Architect Daniel M. Tarczynski provided graphic design for this project.)

APPENDIX III:

WISDOM FROM THE FIELD

Dozens of people in school districts, government, universities, publishing companies and elsewhere reviewed a draft of Tomorrow's Learning Environment, Planning for Technology: The Basics, offering their suggestions of how the report could better serve educators. In this appendix, we share some of the reviewers' most interesting comments about their experiences in facilities planning.

Technology Is Not Just an Add-On

Technology cannot simply be an add-on to existing educational facilities. Careful evaluation and planning are a must. Coupled with examination of effective learning strategies via technology, our educational programs/facilities can move easily into the 21st century.

Barbara Caligiuri
Coordinator of Technical Support
Cupertino Union School District, CA

Budgeting for Technology

Without a percentage of the budget committed to technology and to the personnel needed to prod technology along, technology will not reach its full potential in the classroom. We need intensive training and commitment from national, state, and local governments. We have come a long way but still are running to catch the "train" mentioned in Tomorrow's Learning Environment.

Robert W. Manges
K-12 Educational Technology Coordinator
Ferguson Florissant Public Schools, Florissant, MO

Board, Staff, and Community Involvement in Facilities Planning

In planning for the future, and particularly in developing new educational specifications, we've found the greatest need is to prepare the staff to break through the paradigms under which we work and live. Our district used a futures symposium to precede the development of a new instructional delivery system and the preparation of educational specifications for new schools and remodeling projects.

The futures symposium featured leading educational futurists who spoke on three topics: practical application of technology in the classroom and other areas of school buildings; the environment in which learning and technology takes place; and the human element that demands that we provide for interaction among students, between teachers and students, and among other persons within schools. Small groups of teachers, administrators, parents, and representatives of architectural firms discussed the topics and questioned the speakers. The groups then listed questions, suggestions, and comments on how they felt the district should develop the new instructional delivery system and prepare new educational specifications.

The symposium was held in spring 1988, and is being followed up with a new program called Strategy 2020. At least 20 small groups are now developing an executive summary, lists of problems to be solved, recommendations and assessments of the impact on facilities, costs, and training needs. The sub-committees will report back to three "strand" committees that focus on instructional strategies, organizational structures, and support services. The strand committees' resulting reports will be brought together in a coordinated vision and presented to the board of directors for adoption.

Our discussions have pointed out the need for teachers to observe the many new teaching techniques and technology currently operating in the district. A "New Teaching Practices/Technology Fair" will feature district teachers demonstrating their new teaching techniques that utilize technology. The district will apply an hour of early-dismissal time and paid after-school time to allow teachers to attend the fair. We hope that the fair will make new ideas seem less formidable, as reluctant teachers see their colleagues using new media.

In employing architects, the district requires each architectural firm to have an "educational futurist" on its consulting staff. This allows the district access to those futurists at no additional cost and provides a system for an outside expert to critique the district's process and results.

Eugene R. Hertzke
Superintendent
Central Kitsap School District No. 401, Silverdale, WA

In my experience, effective staff and community involvement throughout the facility planning process have been very difficult to maintain. Consensus takes time and decisions seem to require instantaneous responses in many cases.

Diane Means
Principal
Cupertino Union School District, CA

Board/Staff/Community Involvement and Planning Issues

Board/Staff/Community Involvement:

Before faculty members are involved in the process of helping to program a school, I have learned that it is very important to teach them about the entire process--including the six phases of planning and construction which will take place: programming (development of educational specifications), schematic design (location of rooms and program areas), design development (handling code issues and other specifics), development of contract documents, bidding, and construction. The typical teacher wants to approach the process with his or her own sketches, blueprints, and personal biases about facility design. Instead, teachers must be coached and directed to deal at the conceptual level. If the faculty does not get this coaching before educational programming begins, there will be a huge amount of misunderstanding and considerable conflict during the planning process.

Clear lines of communication between appropriate personnel must be established early in the project. A single representative from the architectural/engineering firm must be designated to communicate with the school board. Likewise, a single representative of the school board must be designated to communicate with the architectural firm. On some occasions, it may be appropriate for both of these individuals to communicate with others in the opposite group, but those occasions should be rare and must include contact with the proper organization representative.

Through these strict lines of communication, we have been very successful in minimizing confusion, side deals, and conflict which can emanate from a school board representative attempting to direct the general contractor or his subcontractors. We have also prevented problems that could arise from representatives of the architectural/engineering firm contacting department chairs, teachers, coaches, and others within the school district.

By law, the board of education must approve change orders to the contract. A critical step is presenting the board with enough information for it to understand the change conceptually and the reasons for associated costs. The school board representative must be able to present the material to the board in layman's language.

It is important for the board of education and the superintendent to understand in advance the need for change orders. School buildings are of such magnitude that individual change orders can easily reach into the tens of thousands of dollars. Board members, attempting to exercise their responsibility to monitor the expenditure of public funds, can become very concerned about change orders unless they are well schooled in the need for, magnitude of, and frequency of occurrence of change orders.

No amount of technology will be useful if teachers are not comfortable with it or do not understand how it can be employed effectively in the classroom. In the same vein, it is important for board members and citizens of the district to understand the value of technology in the teaching/learning process so that parents and board members might accept the cost of building it into educational facilities.

Planning the Media Center:

We struggled with the issue of separating or joining print and non-print media activities. We concluded that they are different enough to justify different locations. In our case, we have a middle school and a high school under the same roof, but students from the two schools will not interact with each other. Therefore, it is necessary to put a print media center in each school. We decided to put an electronic media center between the buildings to act as the "alpha and omega" for all signals moving in and out of the building.

Even had we been building only one school under a single roof, I think it is very likely we would have separated the print and nonprint media centers. The activities of a television studio or a mini/mainframe computer facility are very security conscious, quite active, and would in most cases be inappropriately located in a print media center.

Soliciting Industry for Help With Facilities Planning:

Perhaps the author's approach of convening a workshop for all vendors simultaneously was better than ours. We contacted each of the vendors independently and in several cases found ourselves being contacted by their marketing personnel three to six months later. In several cases, we have received assistance, cash, and hardware. But, of course, we are always interested in more interaction between ourselves and our vendors.

Creating Educational Specifications:

Schools are special places, and they deserve special designs that can make them as functional as possible. We have relied on our architectural firm, which has considerable expertise in planning, and have used our own principals on special assignment as the reality checks and educational leaders for the design of facilities. This process has been very successful for us and we have not found it necessary to employ an outside facilities planner.

Each time we build a school, we learn something new and then try to include our discovery in the next facility. There is always a very healthy interchange between the principal on special assignment and the architectural planning group. We have also used our faculty extensively in the programming, schematic design, and design development phases of planning our schools.

Program Management:

To date, we have not used construction management personnel as an agent for the school district. Our board of education has preferred to maintain a single general contractor to supervise all subcontractors. In the special case of a high school and middle school we are building under one roof, we are building on a "fast track." Therefore, we have had four single prime (general) contractors--one for each building phase. Specifications for each contractor in sequence were written to insist that an independent surveying firm certify that the completed work of contractor number one met the exact specifications of the architectural firm in order to allow the subsequent contractor to take over his portion of the job, and so on. Although we would not recommend this as the best way to build a school, it has been successful to this point and we have had a minimum of conflict between sequential prime contractors.

Hiring Architects and Engineers:

We would certainly endorse the author's emphasis on value engineering and phase cost estimating for any significantly large building project. It is critical that the school find a means of accessing objective opinions from qualified third parties to evaluate the design of the school. School personnel could never be as competent in that area as value engineering firms or individuals.

We also agree with the author on the importance of choosing an excellent architect and not choosing an architectural firm simply because it is local, is known to board members, or has some means of access to the organization. Competence is the most relevant factor in the selection of the architect. We also agree with the author's evaluation of the responsibility levels for errors and omissions by the architect/engineering firm. School buildings of any size will include errors, and it is important that there be a very firm, written understanding betweeen the architect/engineer and the school district about how to handle them.

Thomas F. Wilson
Principal on Special Assignment
Independent School District 196, Rosemount, MN

Flexibility for the Future

Planning for the technology of today without restricting our ability to respond to the potential of technology of the future is the real challenge!

Max O. Heim
Superintendent
Geary County Unified School District 475, Junction City, KS

An area of frustration has been the great need for flexibility in facilities to provide for the changing wiring and cabling needs necessary to handle connections for networking equipment. A great deal of time is spent wiring and re-wiring when new equipment is added or changed and when changes are made to accommodate personnel changes. Quite often there is no provision of where to put the wiring. This can lead to an environment that is unsafe and unsightly.

Even in pre-wired situations, it is difficult to plan what wiring needs would come in the future. It might be a good idea to plan "channels" at the base of walls that would open easily to string new types of cabling when needed. Old obsolete wiring could also be removed easily or re-used for other purposes. The "channels" would have to be designed to fit well within the decor and function of the building. It should be possible to open the channel at any location to tap into the wiring system. This could accommodate wiring for phones, computer networks, cable TV, and any other technology that might require cabling. Connections should all be modular so installation could be done easily.

It's a good idea to link the central district computer to a teacher work area. With enough equipment available, teachers could enter attendance or grade information directly into the computer and eliminate the need for filling out scan sheets.

Paul Rische
Systems Coordinator
Cupertino Union School District, CA

Triumphs and Frustrations

My facilities planning experience has been in providing input regarding instructional technology programs to the architect and facilities planning staff on a conceptual basis for the design of a high school. I also reacted to design plans for an intermediate school for facilities planning staff in a situation where very few changes could be made to the structural design. A triumph: to have rooms designated for computer labs to support the major disciplines and computer science/business/data processing courses in a high school. A frustration: not to know at the time whether the school was going to be an intermediate and/or high school, due to political boundary issues.

Marvin S. Koontz
Director of Instructional Technology
Fairfax County Public Schools, Annandale, VA

We are just opening two new school media centers with automated circulation and the first "school" automated card catalogs in Michigan (two of 300 such systems in the nation to be piloted this year). We are involved in an elaborate county-wide plan to connect 28 school districts via an institutional cable network. Several cooperating cable companies are involved. The system will provide inter -district transmission of data, electronic mail, instructional television, teleconferencing, and the like. Political issues --such as having to request the allocation of channel space from cable commissions and surrounding communities and to negotiate fees and rate structures for line maintenance--impede the process.

Lisa Martinico
Video/Media Coordinator
West Bloomfield Public Schools, MI

School-Wide Networking

Our Centennial High School, scheduled to open in September 1989, will include a wideband video switch information system--the first in the nation for K-12 public education. The wideband digital switch is linked to internal equipment in the school's media center and exterior classrooms by fiber optic cables. Within the switch, there are boards that are input channels and boards designed as output channels. There is a processor built into the switch whcih performs connection services and internal diagnostics.

There are tremendous instructional advantages in using the wideband video switch information system with fiber optic technology. Live telecasts from the school's media studio, interactive video in classrooms, real-time debates using video signals between classrooms, and classroom receptions of cable and satellite transmissions are a few of the technology's applications.

Thomas J. Wilson
Coordinator of Educational Technology
Corona-Norco Unified School District, Corona, CA

Telephone Networks

We're installing a telephone network throughout a building and finding it a major source of behavior change. More public communication and sense of professionalism among teachers are resulting.

Brian L. Benzel
Superintendent
Edmonds School District, Lynnwood, WA

Need for Updating Architects and Engineers

My experience is that existing educational architects and engineers are not up to date on the new technologies and don't help districts in this respect. We may need to do a training session for them. There needs to be some good research on technology's impact on the learning environment.

Orbry D. Holden
Executive Director
Texas Association of School Boards, Austin, TX

APPENDIX IV:

RECOMMENDED READING

RECOMMENDED READING

The following publications are listed in the ERIC database. They are available online from three primary telecommunications services: Dialog, 3460 Hillview Ave., Palo Alto, CA 94303, phone (800) 3-DIALOG; Orbit Search Service/Pergamon Orbit Infoline, 8000 Westpark Drive, McLean, VA 22102, phone (800) 45-ORBIT; and BRS Information Technologies, 1200 Rte. 7, Latham, NY 12110, phone (800) 345-4BRS. Several other telecommunications services, including CompuServe and Addison-Wesley's Einstein service, also provide access to ERIC documents.

Print and microfiche copies of publications that have citations beginning with "ED" are available from ERIC library collections and from the ERIC Document Reproduction Service, 3900 Wheeler Ave., Alexandria, VA 22304-5110, phone (800) 227-3742. Print and microfiche copies of publications that have citations beginning with "EJ" are available from University Microfilms International, 300 N. Zeeb Road, Ann Arbor, MI 48106, phone (800) 732-0616.

GENERAL FACILITIES

Institutional Setting and Children's Lives: An Historical, Developmental and Environmental Perspective on Educational Facilities.
Wolfe, Maxine
November 1986
22p: Paper presented at the Edusystems 2000 International Congress on Educational Facilities--Values & Contents (Jerusalem, Israel), November 16-21, 1986.

Taking the perspective of environmental psycholoIgy, this paper interprets the influence of educational settings upon children's socialization. The physical environment and the social structure it reflects determine the nature of information acquired during socialization. ED282339 EA019439

Evaluating the Effect of Image on the Success of a Facility.
Lilley, H. Edward
CEFP Journal, v23 n3 p7-9 May-Jun 1985

Both the design and image have an effect upon the success of an educational facility in that they affect motivation for both teaching and learning. The components of image include nondeceptive appearance, information availability, logical location, attractiveness, personality, and human needs. EJ320944 EA518929

Evaluating the Completed Project
Earthman, Glen I.
CEFP Journal, v 23 n3 p.5-6 May-Jun 1985

This article on the purposes, process, frequency and instruments of educational facility evaluation emphasizes the importance of obtaining data on the effect a facility has upon its users. EJ320943 EA518928

Guide for Planning Educational Facilities. An Authoritative and Comprehensive Guide to the Planning of Educational Facilities from the Conception of Need through the Utilization of the Facility. Eight Edition.
Jenkins, Judity, Ed.
Council of Educational Facility Planners, International, Columbus, OH, 1985

This document , in a looseleaf format that allows for the easy addition of annual updates, is a compilation of information to be used in the planning of educational buildings from the conception of needs through occupancy and use. Each unit contains numerous photographs, drawings, and figures that illustrate the contents. ED276087 EA018207

Learning Environments: An Instructional Module
Wiley, Ann L.
30 June 1982, 16 pages

This self-instructional module includes learner objectives, text, practice exercises and answer sheets addressing developments in research on learning environments and why instructional technologists should take the lead in applying the resulting knowledge to the design of training areas. Elements covered include classroom size and shape, window and wall structure, and furniture design. The use of color and its psychological effects are also examined. ED252196 IR011458

Managing Facilities Creatively or How to Increase the Educational Yield of Your Community's Investment in Its School Buildings.
Leggett, Stanton
CEFP Journal, v21 n2 p 10-12 Mar-Apr 1983

School administrators can make changes in schools that will help students learn more effectively. Among these changes are improvements in landscaping, teaching spaces, and storage space. EJ278022 EA516252

For the Handicapped: Secure, Warm, Uncomplicated
American School and University, v54 n11 p18-19 Jul 1982
EJ265738 EA515527

Planning a Physical Learning Environment for the Future
Bender, Myron
Journal of Epsilon Pi Tau, v4 n2 p3-9 Fall 1978

Elements necessary in designing physical facilities for industrial arts/technology education programs in higher education are considered: (1) evolving patterns and projection of present trends to accommodate foreseeable changes, (2) designing physical facilities to accommodate unforeseeable changes and (3) considering foundational elements in the actual planning sequence. EJ207682 CE508778

The Physical Form of the School
Evans, Kate
British Journal of Educational Studies, v27 n1 p29-41 Feb 1979

From her study of traditional and open-plan British infant schools, the author shows how school buildings and playgrounds can express social and educational principles by controlling freedom of access; the destruction of defense by open plan architecture being countered, on occasion, by creation of new defense by teachers. EJ207552 AA530003

Pedagogics and the School Environment. Project No. 679. School Research Newsletter.
Lofberg, Arvid; Wahlstrom, Olle
National Swedish Board of Education, Stockholm. May 1979, 11p.

This newsletter summarizes a research project in Sweden aimed at studying the participation of school personnel in the school planning process. The project involved following the planning of three schools in Sodertalje where the personnel had been given the opportunity to participate. ED196172 EA013253

Ergonomics: The Human and the Machine
Mason, Robert M
Library, Journal, v109 n3 p331-332 Feb 15 1984

Discusses aspects of microcomputer operation that are associated with the human operator and the interface between human and machine or workplace. Work productivity, furniture design (desks, seating), keyboards (shape, layout, and "feel" of keys), and video display terminal screens and lighting are noted. EJ295514 IR512238

"Time for Results": An Overview
Alexander, Lasmar
Phil Delta Kappan, v68 n4 p202-04 Nov 1986

Summarizes the work of seven National Governor's Association task forces (on teaching, leadership, parent involvement and choice, readiness, technology, school facilities, and college quality) and the "action agenda" proposed. EJ343772 EA520577

Five-Year Plan for the Minneapolis Public Schools, 1982-1987
Minneapolis Public Schools, Minn. 20 Apr 1982

The purpose of the five-year plan described in this document is to enable the Minneapolis public schools to anticipate and respond to changing educational, economic, and demographic conditions that affect the school district. ED242817 UD023466

The Everyman's University, Israel. A Case Study in Distance Learning Systems.
Seligman, David
Open Univ., Walton, Bletchley, Bucks (England). Jan 1979

A brief description of Israel (physical setting, population, society and culture, economy, politics, and communications) and it educational system introduce a description of Everyman's University. Everyman's University is a nontraditional institution offering postsecondary education by extension to the nontraditional college population. ED183037 HE012015

School Buildings of the Future. Third General Session, Annual International Conference of the Council of Educational Facility Planners, International (63rd, Nashville, TN, September 21-24, 1986.
Gardner, Dwane E.

Using John Naisbitt's "Megatrends" as a guide to learning environments for the future characteristics for the following spaces are delineated: food service, vocational and technical, language centers, health and physical education, libraries and information centers, commons or people places, arts and crafts, administration, and employee and student care centers. EJ350726 EA521115

The Need for Coordination between Educational Facility Planning and Urban Land Use Planning--A Case Study
Hill, Franklin
CEFP Journal, v21 n3 p406 May-Jun 1983

A case study of urban area planning shows lack of communication between levels of government and with educational planners. Recommendations are made for an interagency planning council. EJ283805 EA516473

Color Selection--A Key Element in Learning
Smith, Nancy R.
CEFP Journal, v18 n2 p6-7 Mar-Apr 1980

Modern principles of color applied to schools will greatly improve the scholastic performance of students. EJ221607 EA512824

What Is An Educational Specification?
Graves, Ben E.
American School and University, v53 n4 p18-19 Dec 1980
EJ236697 EA513690

Answers to Your Facility Planning Questions
Graves, Ben E.
American School and University, v53 n2 p14-15 Oct 1980

Outlines the process for selecting an architect. EJ234144 EA513464

School Facilities: A Component of Educational Reform?
Hawkins, Harold L.
CEFP Journal, v24 n6 p23-25 Nov-Dec 1986

Examines the treatment accorded the physical environment in five of the recent educational reform reports. Cites state activities in educational facility planning and areas where research is needed to articulate the school building requirements. EJ345275 EA520651

Physical Space: From Concept to Reality
Hawkins, Harold L.
CEFP Journal, v23 n4 p11-14 Jul-Aug 1985

Presents the history, ideal level of utilization, and current reality of six educational facility concepts: openness, space relationships, quantity, quality, suitability, and flexibility. EJ323632 EA519129

Guide for School Facility Appraisal. 1986 edition.
Hawkins, Harold L; Lilley, H. Edward
Council of Educational Facility Planners, Columbus, Ohio, 1986

This guide provides evaluative criteria for the elementary--secondary administrator to measure the quality of a school's facilities for general condition and suitability for educational programs. Appraisal criteria and instruments are categorized into six major areas of discussion: "The School Site," "Structural and Mechanical Features," "Plant Maintainability," School Building Safety," Educational Adequacy," and "Environment for Education." ED270899 EA018601

Facility Planning for 21st Century. Technology, Industry, and Education
Hill, Franklin
Nov 1986, Paper presented at the Edusystems 2000 International Congress on Educational Facilities--Values & Contents (Jerusalem, Israel, November 16-21) ED282324 EA019419

The Future Outlook for School Facilities Planning and Design
Brubaker, C. William
20 Oct 1985, Paper presented at the Annual Meeting of the Council of Educational Facility Planners (62nd, San Jose, CA, October 18-21, 1985

School design is influenced by four major factors: the education program, the community site, education technology, and building technology. Schools of the future are discussed in relation to the factors affecting school design. ED261469 EA018009

Learning Environment in Curriculum Evaluation: A Review
Fraser, Barry J.
Evaluation in Education: An International Review Series, v5 ni p3-93, 1981

Research on three classroom environment instruments is discussed, including predictive validity studies and criterion validity studies. Evidence suggests that curriculum influences classroom environment, which influences student learning. EJ248017 TM506177

Social-Psychological Environments and Cognitive Achievement
Randhawa, Bikkar S; Hunt, Dennis
Saskatchewan Univ., Saskatoon, Coll, of Education, April 1981

Differences in social-psychological environments between parochial and public schools, and between mathematics and English courses, were investigated involving 317 grade 10 boys and girls. Incremental validity of learning environment in the context of IQ with achievement is also substantial. Implications for instructional effectiveness and school organization are discussed. ED205559 TM810441

How to Plan Tomorrow's Schools Today
Hill, Franklin
School Administrator, v44 n6 p10-12 June 1987

Describes the partnership between high-tech industries and the schools in Orlando, Florida, which resulted in the planning and development of a $30 million high school known as "The Educational City of the Future." EJ356723 EA521354

Creative Capital Financing: Lease Purchase and Leasing Air Space (The Florida Approach)
Hill, Franklin
CEFP Journal, v21 n6 p14-15 Nov-Dec 1983

Among recent creative financing arrangements for public sector construction in Florida are the Duval County Central Administration Building, constructed with a lease purchase arrangement, and state legislation that provides for the leasing or sale of air space by local school boards or boards of regents. EJ294918 EA517319

Shedding Light on Learning.
Graves, Ben E.
American School and University, v57 n7 p88,90 Mar 1985

Summarizes findings of an Albert light/color study that looked at mood, noise levels, IQ test scores, blood pressure, and absences under fluorescent or full-spectrum light in two color schemes in four elementary schools with 700 students. EJ313724 EA518649

MEDIA CENTER

Media Specialist Handbook: You Are the Key
Georgia State Dept. of Education, Atlanta. Office of Instructional Services. 1985

Target Audience; Media Staff; Practitioners. Developed as a basic resource for Georgia school media personnel, this handbook draws together the information most frequently needed by media professionals across the state. ED281522 IR012643

Trends in School Library Media Facilities, Furnishings, and Collections
Bennett, Jim
Library Trends, v36 n2 p317-25 Fall 1987

This description of trends in school library media facilities identifies function, aesthetic values, and behavioral expectations as key components of school library design. The use of library space by students and staff and the impact of electronic technology are also discussed. EJ366397 IR517912

A Media Center for the 21st Century
Lamkin, Bernice
School Library Journal, v33 n3 p25-29 Nov 1986

Describes the planning and organization of a media center for a new high school bulding in Michigan. The philosophical issues considered are discussed in terms of current and future needs and the technology available, and the school's computerized electronic access system for instructional and administrative use is described. EJ345853 IR516092

How to Work with an Architect
Lewis, Myron E.; Nelson, Mark L.
Wilson Library Bulletin, v57 ni p44-46 Sep 1982

Discusses the working relationship between librarians and architects in handling feasibility studies, site evaluations, budget considerations, time line predictions, and the architectural programing involved in library building projects, whether it be replacing, expanding, remodeling, or relocating. EJ270039 IR510539

Library Learning Resources Facilities--New and Remodeled
Morrison, LaVerne; and others
Texas Education Agency, Austin June 1982

This guide to the planning and design of school library or learning resources centers (LRC) is divided into two parts. Guidelines provided in the first section cover the planning responsibilities of the district LRC director and the learning resources specialist/librarian; development of educational specifications; location; required spaces; furniture; security systems; accessibility by the handicapped; and special areas such as darkrooms, television and microcomputer center facilities, and teacher workrooms. Also included are sample educational and furniture specifications, recommendations for space allocation, and a check list of the kinds of information needed to develop specifications for a specific LRC. ED220113 IR010364

A Guide for Planning and Construction of Public School Facilities in Georgia. Media Center Facilities, Revised.
Georgia State Dept. of Education, Atlanta, 1982

The purpose of this guide is to facilitate the work of Georgia planners in systematically determining the size, nature, and functions of spaces needed for the construction or renovation of media center facilities after the minimum requirements for school media centers established by the Georgia Board of Education have been met. ED228723 EA015573

COMPUTERS

Radiation, Ergonomics, Ion Depletion, and VDTs: Healthful Use of Visual Display Terminals.
Miller, R. Bruce
Information Technology and Libraries, v2 n2 p151-58 Jun 1983

Discusses health hazards associated with use of visual display terminals (VDTs) and provides guidelines for safe use of VDTs in the following areas: radiation, design of work stations, design of VDTs illumination, glare work/rest periods, visual testings, ion depletion. An 11-item annotated bibliography of recommended readings and bibliographies is included. EJ286964 IR511656

Andrew: CMU's New Computing Environment
Zabowski, Susan
Engineering Education, v 77 n3 p161-66 Dec 1986

Reviews the progress and problems associated with the development of Carnegie Mellon University's new computing and communications system, "Andrew". EJ354646 SE540700

Computer-Assisted Instruction in Mathematics
Hoffman, Ruth Irene
Pipeline, v6 n2 p12 Fall 1981

The mathematics laboratory at the University of Denver is described and its use of microcomputers is discussed. EJ255510 SE530574

Distance Learning--Are You Ready?
Graves, Ben E.
American School and University, v57 n4 p53 Dec 1984

Describes a regional forum on "distance learning' (including telephone, radio or television, and downloading computer software from a central location) that was sponsored by the Southwest Educational Development Laboratory. EJ309978 EA518237

Impact of the Microcomputer on the Physical Environment for Learning
Parker, James A.
1983, Paper presented at the Annual Meeting of the Council of Educational Facility Planners (Orlando, FL, October 29-November 3, 1983)

This paper provides an exploration of the impact of the increasing use of microcomputers in education upon curriculum development and the physical space needs in the learning environment. A secondary topic is the present and future directions of schools in the design of computer environments. ED250835 EA017360

SCIENCE AND LABORATORIES

Safety in the Chemical Laboratory: Designing a Safe Academic Chemistry Building.
Chlad, Frank L.; Houser, John J.
Journal of Chemical Education, v56 n9 p277-80 Sep 1979

The new chemistry facility at the University of Akron, heralded as one of the safest chemistry buildings ever constructed, is described. Topics discussed include: preliminary planning, general building design, design of specific areas, and safety training for personnel. EJ211604 SE525838

Spacelab. An International Short-Stay Orbiting Laboratory.
Froelich, Walter
National Aeronautics and Space Administration, Washington, D.C.
Oct 1983

Spacelab is a facility which enables scientists and engineers to go into space for in-orbit research studies. For the 10 European nations that designed, constructed, and financed Spacelab jointly through the European Space Agency and for the National Aeronautics and Space Administration, which designed, constructed, and financed the Spacelab ground facilities and manages the Spacelab flights, this is the culmination of history's largest and most comprehensive multinational space project. Provided in this document is information on: (1) the nature of Spacelab; (2) interior design, equipment, and facilities; (3) Spacelab crew; (4) materials science and space plasma physics experiments; (5) experiments in the life sciences, astronomy and solar physics, and atmospheric physics and earth observations; (6) activities involved in a typical day aboard Spacelab; and (7) Spacelab's birth , impact, and future. ED237361 SE043575

Effects of Noise on Student Performance
Jewell, Larry R.
Journal of Vocational Education Research, v5 n3 p47-53 Sum 1980

This study provides experimental evidence that noise intensities typical of those found in vocational education laboratories are detrimental to student performance. As noise intensities increase in the learning environment, the time required to complete assigned tasks increases. EJ238046 CE510475

A Master Plan for Science
Hill, Franklin
American School and University, v57 n10 p62,64,66 Jun 1985

Faced with increasing enrollment and state legislation requiring more laboratory work , this school system hired an architectural firm to devise a cost-effective "District-wide Science Facility Master Plan." The process of developing that plan and some of its conclusions are described here. EJ320955 EA518950

NSBA
LEADERSHIP FOR PUBLIC EDUCATION
National School Boards Association
1680 Duke Street
Alexandria, VA 22314
703/838-NSBA